THE
SIMPLE LIFE
SERIES

SCIENTIFIC NUTRITION SIMPLIFIED

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A CONDENSED STATEMENT & EXPLANATION FOR EVERYBODY OF THE OBSERVATIONS OF CHITTENDEN, FLETCHER, AND OTHERS

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With a Supplementary Chapter

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PREFACE

THE object of this book is to present in concise form and in language free from technicalities a popular summary of the information necessary for the practical application of the new principles of nutrition advanced by Mr. Horace Fletcher, Prof. Russell H. Chittenden, Prof. Irving Fisher and other investigators.

Although the subject has been most ably presented from the point of view of its foremost layman, from the point of view of one of the highest scientific authorities in America, and from the point of view of a famous political economist, it has not yet been treated by a private person who has tested the merits of the system in his own life and found it good.

It is this task that has been attempted here. In his fifty-fourth year, the originator of this book felt that he was ageing rapidly, going painfully down the wrong side of the hill of life and giving up one by one all the pleasures that had made living attractive to him. He had lost his power to work, his enjoyment of social pleasures, and all his interest in intellectual pursuits. He suffered from intense pain which he took to be muscular rheumatism, and, at times, from a mild form of aphasia. His one object was to get done with his necessary work as rapidly as possible and go to bed. Sometimes he was so overcome with weakness, dizziness and fatigue in the middle of the day that he was forced to go to his club and lie down for an hour or so before he could go on with his work.

To-day he is in better health than he

has enjoyed since he was a boy and feels that—barring accidents—he should live to be a hundred. For this he has to thank the new system of diet described in the following pages.

The best part of the new plan is that it costs nothing to adopt it. It requires no expensive apparatus, no consultation of specialists, no change of climate, no release from daily work; it is a mere matter of getting and applying certain easily understood information.

However, as a busy professional man, he realizes how difficult it is for a man engaged in the exacting and complicated occupations of modern life to search out this information through the various books in which it is to be found and to devise a method for applying it. Therefore he has secured a digest of the points which he has found most valuable in working out his own problem with the

idea of presenting a sort of lawyer's brief of the subject.

His hope is that the work will attract the attention, not only of men and women, who in the prime of life are suffering—as he was himself at one time—from all the symptoms of old age, but of the young men and women whose constitutions are subjected to the strain of commercial life; of the boys and girls in the schools and colleges whose bodily forces are taxed to the utmost by the exactions of modern education; and of the parents and educators who have the guidance of the lives of the coming generation. It is his sincere conviction that the application of the principles recommended will yield an immense increase of energy for daily work and will add many useful years to their lives.

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INTRODUCTION

WHEREVER one may look over the civilized world to-day, he will find in progress a systematic movement for the improvement of the race. In every country the greatest scientists are giving their best efforts to the study of the human organism, while sociologists, economists, reformers and philanthropists are labouring by means of popular health movements to build up a people with strong and vigorous bodies.

These numerous and varied activities have one point in common—a vigorous

insistence upon the importance of more intelligent ways of feeding. In the face of the perhaps not wholly unwarranted prejudice against any attempt at a scientific regulation of diet, laboratory investigators and social workers are urging the members of the human race to learn to feed themselves with at least as much wisdom as they have used for years in the feeding of their domestic animals—the physicians and physiologists declaring that practically all functional disorders have their rise in faulty nutrition, and the sociologists, political economists and social workers asserting just as emphatically that much of the poverty, vice and crime of the world is directly traceable to errors in diet.

"We eat or drink for health or ill-health," says Dr. Daniel S. Sager. "Explain it as you will, this is the only way in which disease can occur in the human

body. . . . Aside from surgery and midwifery, the practice of medicine for the most part revolves about the stomach. . . . While medical science has thousands of names for diseases, at bottom all diseases are alike. Poisonous principles are thrown into the blood and the result is disease. There are several hundred organs and tissues in the body, each one of which, when affected, gives a name to a disease; but while the names of diseases are different, yet the cause which produces them is generally the same—over-eating, which produces auto-intoxication, self-poisoning, malassimilation, premature old age or disease,—call it what you will. The conditions which produce Bright's disease will also produce gout, rheumatism, cancer, or appendicitis."[1]

This is the view of a modern physician.

[1] Sager, "The Art of Living in Good Health," pp. 8, 168, 179.

Professor Irving Fisher of Yale, speaking as a political economist, says:

"Much attention is now being paid to the physiological condition of the labouring classes, their housing, the sanitation of factories, hours of labour, child labour, etc. Equally important is the problem of the nutrition of these classes. Industrial inefficiency is the price of malnutrition. Increased labour power will be the practical outcome of diet reform."[1]

Out of this agitation there has at last emerged a complete new conception of dietetics, the chief recommendation of which is that it gives the best results of a scientifically regulated dietary in combination with the advantages of a reliance upon instinctive promptings of taste and appetite.

The new conception has been fittingly

[1] Irving Fisher, Ph.D., *The Independent*, August, 1907.

named "economic nutrition" because its fundamental purpose is to save the body from unnecessary labour through a reduction of food to exact physiological needs.

This, the originators of the new conception point out, is an unqualified advantage to anyone. Every ounce of food over and above the amount necessary to furnish building materials during growth, to repair tissue that has been broken down by muscular exercise, and to supply fuel to keep the body warm and energy to keep it running, compels the organs to perform the thankless task of dealing with this excess of food for the sole and exclusive purpose of getting it out of the way.

The new view attacks the deep-rooted idea in the mind of man that everything he is able to eat will do him good, and that he will surely receive a return for

it, either increased energy for work, or in a reserve which he can call upon some day when he needs it. On the contrary, it points out that food in excess of physiological requirements does not yield increased energy for work, but actually takes the energy that might be given to work; furthermore, that food cannot be stored by the body in any considerable quantity, and the residue which is left floating about in the blood is a source of disease to the human organism.

This principle applies with particular force to the class of foods which forms the great staple of the diet of most of the civilized people of the world: the tissue-building or "proteid" foods, consumed chiefly in the form of meat, fish, eggs, and in a lesser degree in peas, beans, lentils, nuts and cheese. The reason for this is that these foods—unlike the fuel-producing foods found in grains, fruits,

vegetables, butter and oil—cannot be completely burned up by the body, but leave behind them a solid "ash," which, as Dr. Edward Curtis has expressed it, "must be raked down by the liver and thrown out by the kidneys."[1]

If you think of the body in the light of an engine, the idea at once becomes clear. After you have built your engine you do not feed it on brass, iron and copper: you feed it on coal. It is true you have to put iron and steel and copper into it now and then, when repairs become necessary, but not in such quantities like the coal you have to use to keep it running. It is obvious that if you put iron and steel and copper into the furnace in amounts equal to or exceeding the coal, it would soon wear out or break down.

[1] Edward Curtis, M.D., "Nature and Health," p. 70.

This is exactly what the originators of the new theories of dietetics say happens to the human body when it is fed upon building material in excess of fuel. To the common practice of eating more meat than vegetables they attribute most of our ills. Furthermore, they declare that it is our excessive eating of "high-proteid" foods, like meats, that cuts us off in our prime at seventy or eighty or so, when, according to the biological law that the lifetime of an animal should be from five to seven times the growing period, he should live to be a hundred at the very least.

It must therefore be evident that the new discovery is of immense importance to practical men and women with work to do in the world. Most of us experience only brief spurts of our maximum efficiency, although we should like to be always efficient. If it be true that

one of the leading causes, if not the leading cause, of the sense of inefficiency that hangs over us like a pall is an excess consumption of food—then the new diet plan supplies us with at least one effective means of tapping those "new levels" of energy that Professor James speaks of in his famous essay, "The Powers of Men."[1]

For the benefit of those who may be inclined to reject the new plan on the grounds that it will interfere with the pleasures of the table, it may be stated that the universal testimony of those who have adopted it is, that they never realized what true enjoyment of food was before they tried it. On this point Professor Chittenden says:—

"Simplicity of diet does not diminish but rather increases the pleasure of eat-

[1] Professor William James, "The Powers of Men," *American Magazine*, November, 1907.

ing, especially when the daily restriction—indulged in until a new habit is formed—has created a greater keenness of appetite, since under such conditions the palate takes a new sensitiveness, and manifests a fuller appreciation of the variations of even a simple dietary. There is therefore no hardship, nor curtailment of the pleasure of eating in the restriction of the diet to the real needs of the body. Neither is there implied any cessation of that kindly hospitality that delights in the 'breaking of bread' with one's friends. With enlightened methods of living, on the other hand, will come a truer appreciation of the dignity of the body, and a lessened desire to manifest one's feelings of hospitality by a lavish intemperance that is as unphysiological as it is wasteful."[1]

To those who are timid about adopting

[1] "Physiological Economy in Nutrition," p. 472.

it because their "doctors told them it was dangerous to cut down the food that makes muscle," it may be pointed out that no one—doctor or not—who has not made an exhaustive study of the subject with the same thoroughness or the same facilities as its originators is qualified to give an authoritative opinion regarding it. The theory is an advance over old ways of thinking and cannot, therefore, be tested by any but the most advanced ideas.

Everyone will concede that there is a limit to the quantity of food that can be consumed with advantage. For example, everyone will agree that ten pounds a day is too much—or nine pounds, or eight pounds, and so on—but in the descending scale there comes a point where a doubt as to the sufficiency of the amount will be justified. That this point, below which it is dangerous

to reduce the consumption of food, can be determined by science, will hardly be disputed. Every investigation of the subject has endeavoured to fix it. In the generally accepted "diet standards," the minimum quantities of food commonly consumed by man have been accepted as the minimum quantities required.

"Within certain rather wide limits," says Professor Chittenden, "there is an apparent tendency for people of different nations, having a free choice of food and not restricted by expense, to consume daily approximately the same amounts of nutriments; to use what may be called liberal rather than small amounts of food; and lastly, to consume food somewhat in proportion to the amount of work done. It is perhaps, therefore, not strange that students of nutrition should have taken these results, obtained by the statistical method, as indicating

the actual needs of the body for food, and that so-called 'standard diets' and 'normal diets' should have been constructed, based upon these and corresponding data. . . . These standards covering the quantities of food per day 'are intended to show the actual food requirements of persons under different conditions of life and work.' Here, however, lies an assumption which seems to meet with wide acceptance, but for which it is difficult to conceive any logical reason. The thousands of dietary studies made on peoples all over the world, affording more or less accurate information regarding the average amounts of proteid, fat, and carbohydrate consumed under varying conditions, are indeed most interesting and important, as affording information regarding dietetic customs and habits; but the writer fails to see any reason why such data need be

assumed to throw any light on the actual food requirements of the body. In the words of another, 'Food should be ingested in just the proper amount to repair the waste of the body; to furnish it with the energy it needs for work and warmth; to maintain it in vigour; and, in the case of immature animals, to provide the proper excess for normal growth, in order to be of the most advantage to the body' (Benedict). Any habitual excess of food, over and above what is really needed to meet the actual wants of the body, is not only uneconomical, but may be distinctly disadvantageous. . . . With these thoughts in mind, may we not reasonably ask why it should be assumed that there is any tangible connection between the dietetic habits of a people and their true physiological needs? Arguments predicated on custom, habit, and usage have no physiological

basis that appeals strongly to the impartial observer. Man is a creature of habits; he is quick to acquire new ones when his environment affords the opportunity, and he is prone to cling to old ones when they minister to his sense of taste. The argument that because the people of a country, constituting a given class, eat a certain amount of proteid food daily, the quantity so consumed must be an indication of the amount needed to meet the requirements of the body, is as faulty as the argument that because people of a given community are in the habit of consuming a certain amount of wine each day at dinner their bodies must necessarily be in need of the stimulant, and that consequently alcohol is a true physiological requirement."[1]

Accordingly, Professor Chittenden, ac-

[1] Chittenden, "Nutrition of Man," pp. 157–9.

tuated by his belief that what a man eats is no guide to what he should eat, has shown by a series of elaborate experiments, extending over long periods of time, that persons of widely varying habits of life, temperament, and constitution, can maintain and even heighten their mental and physical vigour, on far smaller quantities of food than these "minimum requirements" of the diet standards. Since the point to be determined is the quantities of food men can live on, not what they do live on, it appears safe to assume that Professor Chittenden has come nearer than anyone else to determining the minimum food requirements of man.

Secondly, everyone must concede that it is possible for science to ascertain the minimum requirement of man for proteid food, and also to ascertain whether the quantities of proteid in excess of this

amount are of advantage or of disadvantage to the body. So far no one has been able to refute Professor Chittenden's conclusion, drawn from his elaborate experiments, that the quantities of proteid consumed by the average man are far in excess of the quantities assimilated, and that the excess of proteid not assimilated is of unqualified disadvantage to the body.

Thirdly, everyone will agree that it is possible for science to determine whether or not the complete mastication advocated by Horace Fletcher is of any specific value to the nutritive processes. So far all the scientists who have investigated the matter have been convinced that it is. The remarks of Elie Metchnikoff in his book, "The Prolongation of Life," which have been taken by some persons as a scientific refutation of the claims of Mr. Fletcher's theory, are

of an extremely casual nature, and are based, not upon extensive investigations such as will be described in this book, but upon the statements of a single physician, who, in a small pamphlet, has published an account of his observations upon two persons suffering from an intestinal disease which he attributed to the fact that they gave an unusual amount of care to the mastication of their food. The remarks in question are as follows:—

"The habit of eating quickly favours the multiplication of microbes around about the lumps of food which have been swallowed without sufficient mastication. It is quite harmful, however, to chew the food too long, and to swallow it only after it has been kept in the mouth for a considerable time. Too complete a use of the food material causes want of tone in the intestinal wall, from which as much

harm may come as from imperfect mastication. In America, where Fletcher's theory took its origin, there has already been described, under the name of 'Bradyfagy,' a disease arising from the habit of eating too slowly. Einhorn, a well-known specialist in the diseases of the digestive system, has found that several cases of this disease were rapidly cured when the patients made up their minds to eat more quickly again. Comparative physiology supplies us with arguments against too prolonged mastication. Ruminants, which carry out to the fullest extent Mr. Fletcher's plan, are notable for extreme intestinal putrefaction and for the short duration of their lives. On the other hand, birds and reptiles, which have a very poor mechanism for breaking up food, enjoy much longer lives."[1]

[1] Metchnikoff, "The Prolongation of Life." London, William Heinemann.

Mr. Fletcher himself has pointed out that there is danger in carrying the practice of mastication to extremes. Once the swallowing impulse has asserted itself, he says, there is no advantage in and there may be direct injury from attempting to hold the food in the mouth, even if it has not been reduced quite to the point of complete liquefaction and tastelessness.

Metchnikoff's statement that the ruminants are notable for intestinal putrefaction and shortness of life is at least open to question. The experiments of Dr. C. A. Herter with animals of all classes indicate that, while the bacteria in the intestines of the fast-eating animals (such as cats, dogs, lions, tigers and wolves) are of a deadly character, the bacteria in the intestines of the slow eaters (such as buffaloes, goats, horses and elephants) are practically

harmless.[1] And while it may be true that the lives of birds and reptiles are longer than those of ruminating animals, it has yet to be proved that the lives of fast-eating animals are longer than those of the ruminants.

The practical experience of everyone who has adopted the new plan supplies ample evidence that it is productive of only the best possible results. We have now to see that the reason it produces these good results is because it rests on a firm basis of scientific truth.

[1] C. A. Herter, M.D., "Character of the Bacterial Flora of Carnivorous and Herbivorous Animals," *Science*, p. 859, December 28, 1906.

CHAPTER I

Topics: Mr. Fletcher's discovery and his quest for scientific endorsement. The test of his claims at Cambridge. Opinions of Sir Michael Foster and Dr. Hubert Higgins. Observation of the system at Yale. Dr. Anderson's report. Professor Chittenden's experiments on professional men, soldiers, athletes and dogs. Professor Fisher's experiments upon students and upon meat-eaters and vegetarians. Summary of the evidence.

LIKE many another discovery of the highest value to science, the principles of the new conception of dietetics set forth in this book were hit upon by accident and applied in everyday life before they were worked out in theory; and, like many another great discovery, they had to bear the brunt of popular ridicule before they were stamped with the seal of scientific recognition.

Only a few years ago the mention of

the word "Fletcherism" was enough to provoke a laugh. A mere American business man, without any scientific authority whatever, was declaring from the housetops that he had stumbled upon a great truth in regard to human nutrition that the authorities on dietetics had overlooked. His contention was based on the fact that by chewing both his solid and liquid food until, literally, there was nothing left of it, he had cured himself of a complication of diseases and made himself eligible for life insurance, although only a short time before he had been rejected as an unsafe risk.

He asserted that the practice of thorough mastication had revealed to him that one-half the quantities of food consumed by the average man was more than enough to meet all true bodily needs; and that when the faculty of taste was given a chance to pass on

everything taken into the mouth, the appetite was not only satisfied with much smaller quantities, but that it indicated a preference for vegetable rather than animal food and tended to reject alcoholic liquors, tea, coffee, and most condiments.

Although a member of some of the most famous clubs in the country and a social favourite in San Francisco, New Orleans, Chicago, New York, and generally throughout America, Mr. Fletcher suddenly found himself an object of ridicule. He and his chewing-cult were made the subjects for endless humorous newspaper paragraphs. He was cartooned and lampooned from one end of the country to the other. Some of his friends, shocked and offended at seeing a man they knew rapidly becoming a national joke, actually cut his acquaintance.

Nothing daunted, however, Mr. Flet-

cher went serenely on his way, talking of his discovery whenever and wherever he could get anyone to listen, and finally hurling defiance in the faces of his critics by writing a pamphlet on the subject, which is now incorporated in his book, "The New Glutton or Epicure."[1] His method of eating as set forth in this volume may be briefly summarized as follows:

Eat only when there is a vigorous appetite, expressed, not in a gnawing of the stomach—never pay any attention to that—but in a watering of the mouth. If there is no appetite, wait—even if you have to omit a few meals.

Never eat when you are hurried. If you haven't time to give full attention to the taste of a meal, don't eat until you can get time.

Never eat when you are worried, angry,

[1] Fletcher, "The New Glutton or Epicure."

exhausted or unhappy. It is better to go without food for a week than to eat when the negative emotions have you in their grip.

Masticate all food, liquid as well as solid, until it is sucked down into the throat by an involuntary swallowing impulse, giving attention, not to the mechanical movements of chewing, but to the sensations of taste provoked thereby.

Remove from the mouth the tasteless residue. It can be done without observation, and it is better to risk criticism than to make a waste-basket of the stomach.

The result of this practice of eating, Mr. Fletcher declared, was a utilization of food so complete as practically to do away with the decomposing waste products of the body and to leave nothing to the organs of excretion but an inoffensive deposit of cellulose and other dry, unabsorbable material.

The first recognition of his theory which Mr. Fletcher received from the scientific world came from a brief review of this book in the London *Lancet*, in which the author, Dr. Joseph Blumfield, intimated that Mr. Fletcher had apparently stumbled upon some physiological truths that had been overlooked by the experts and that might be well worth their while to look into.

This gave Mr. Fletcher a new idea. It was to get the endorsement of science for his discovery—and he started out seeking for authorities forthwith.

Dr. Ernest Van Someren, an English physician, was the first member of the medical profession whom he succeeded in persuading to test his claims for the practice of what he called "physiologic mastication." Dr. Van Someren, who had long been a sufferer from a case of gout which had refused to yield to the

treatment of a London specialist, adopted Mr. Fletcher's plan of prolonging the mouth treatment of food, both liquid and solid, until its taste had been extracted and it was sucked down into the throat by the "involuntary swallowing impulse," and, in the course of a few weeks, his symptoms began to disappear.

His conversion was complete. He initiated a series of experiments upon his own account and set forth the results in a paper which he presented first to the British Medical Society, and later, more elaborately, before the International Congress of Physiologists at Turin, Italy, in 1901.[1]

The paper created a sensation among the physiologists, and brought Mr. Fletcher and Dr. Van Someren an invitation from Sir Michael Foster to visit Cambridge

[1] For this paper see "The A. B.—Z. of Our Own Nutrition," pp. 27–46.

University in England and submit their theory to scientific tests at the hands of Dr. F. Gowland Hopkins and the other physiological experts in the Cambridge laboratories.

These experiments brought the subject definitely and permanently before the scientific world. Dr. Hubert Higgins, demonstrator of anatomy at the University, after trying the system recommended by Mr. Fletcher and Dr. Van Someren upon himself, and thereby reducing his weight from two hundred and eighty-two to one hundred and ninety-six pounds, became so enthusiastic that he wrote a book on the subject to prove, on grounds of pure science, that the practice of "physiologic mastication" would contribute largely to the complete regeneration of the human race.[1] Sir Michael Foster, permanent honorary president of the

[1] Dr. Hubert Higgins, "Humaniculture."

International Congress of Physiologists, published a " Note " in which he declared that the observations upon Mr. Fletcher and Dr. Van Someren established beyond all question that a full and careful study of their contention was urgently called for.

" In the two individuals who pushed the method to its limits," wrote Sir Michael Foster, "it was found that complete bodily efficiency was maintained for some weeks upon a dietary which had a total energy value of one-half that usually taken, and comprised little more than one-third of the proteid consumed by the average man. . . . The scientific and social importance of the question is clearly immense, and it is greatly to be desired that its study should be encouraged." [1]

[1] For full text see "The A. B.—Z. of Our Own Nutrition," pp. 48–52; or "The New Glutton or Epicure," pp. 18–24.

The reports of the Cambridge experiments aroused the interest of Dr. Henry P. Bowditch of Boston, and, through him, of Prof. Russell H. Chittenden, President of the American Physiological Society, Director of the Sheffield Scientific School at Yale, and one of the leading physiological chemists of the world. Professor Chittenden invited Mr. Fletcher to come to Yale and submit himself to further observation in order that the scientists of America might investigate the claims of the new theory.

The story of how Mr. Fletcher went to Yale, and, on a diet of breakfast food, milk and maple sugar, beat the records of some of the best athletes in the University, has already been made familiar to the people of this country by the newspapers. However, in order that the tale may bear the weight of scientific authority, it may be well to give here the

official report of the endurance tests written by Dr. W. G. Anderson, director of the Yale gymnasium.

"I gave to Mr. Horace Fletcher the same kind of exercises we give to the varsity crew," wrote Dr. Anderson. "They are drastic and fatiguing and cannot be done by beginners without soreness and pain resulting. The exercises he was asked to take were of a character to tax the heart and lungs, as well as to try the muscles of the limbs and trunk. I should not give these exercises to freshmen on account of their severity.

"Mr. Fletcher has taken these movements with an ease that is unlooked for. He gives evidence of no soreness or lameness, and the large groups of muscles respond the second day without evidence of distress after or during the endurance test, that is, the long run. The heart is fast but regular. It comes back to its

normal beat quicker than does the hearts of other men of his weight and age.

"The case is unusual, and I am surprised that Mr. Fletcher can do the work of trained athletes and not give marked evidences of over-exertion. My conclusion, given in condensed form, is this: Mr. Fletcher performs this work with greater ease and with fewer noticeable bad results than any man of his age and condition I have ever worked with."[1]

In making these tests the investigators took care to assure themselves that Mr. Fletcher's records were not accounted for by the fact that he had been an athlete in his youth, or on the grounds that he was a somatic freak of abnormal muscle development. Other men who had been practising his system of eating were subjected to the same tests and it

[1] "The New Glutton or Epicure," pp. 32–3.

was found that they surpassed Mr. Fletcher in just so far as they had a natural advantage over him in youth or physical training.

The tests convinced Professor Chittenden that the amounts of food ordinarily consumed — particularly of the food known as "proteid," which is eaten chiefly in the form of meat—were far in excess of the real needs of the body. Therefore he initiated a series of experiments upon men of widely differing dietary habits, activities, temperaments, and physical condition, extending over a long period of time, with a purpose of determining what was the minimum of food—particularly proteid food—upon which the average person can maintain himself in physical and mental vigour.

The subjects of the first experiment were Professor Chittenden himself; Dr.

Lafayette B. Mendel and Dr. Frank P. Underhill, two other physiological chemists in the Sheffield Scientific School; Dr. Arthur L. Dean, instructor in plant physiology in the same institution, and Mr. George M. Beers, a clerk in the treasurer's office.

While the work of these men was chiefly mental, they could hardly be classified strictly as sedentary, because —with the exception of Mr. Beers— they all had to be on their feet and moving about in their laboratories for the greater part of every day.

As Professor Chittenden's purpose was not to test the merits of Mr. Fletcher's claims for the benefits of mastication, but to ascertain the exact physiological requirements of man for food in general and proteid food in particular without introducing any conditions, he did not require his subjects to masticate their

food with any unusual degree of care. The only change he made in their accustomed dietarics was prescriptively to reduce the amount of meat and other proteid food about one-half. During the six months that the subjects were under observation their weight remained stationary, they improved in general health and experienced a quite remarkable increase of mental clearness and energy. Furthermore, the laboratory tests revealed the fact that the composition and general character of the blood remained unimpaired and that the systems were in "nitrogenous equilibrium"—which means that the men were not paying out more than they were taking in, a condition of prime importance to the maintenance of health.

To meet the objection that the new diet theory, while meeting fully the requirements of persons of dainty dietary

habits and high intellectual development, might fail to satisfy men of a more material mould, Professor Chittenden used for his next experiment a detachment of twenty soldiers, volunteers from the hospital corps of the United States Army, only thirteen of whom, however, really took part as subjects. For six months these men were quartered in a building near the Sheffield Scientific School at New Haven under command of Dr. Wallace De Witt, First Lieutenant and Assistant Surgeon of the United States Army, and subject to constant surveillance of the commanding officer and the non-commissioned officers.

"They represented," says Professor Chittenden, "a great variety of types: of different ages, nationalities, temperaments, and degrees of intelligence. They were men accustomed to living an active life under varying conditions,

and they naturally had great liking for the pleasures of eating. Further, it should be remembered that, although the men had volunteered for the experiment, they had no personal interest whatever in the principles involved, and it could not be expected that they would willingly incommode themselves, or suffer any great amount of personal inconvenience. Again, there were necessary restrictions placed upon their movements, when relieved from duty, which constituted something of a hardship in the minds of many of the men and added to the irksomeness and monotony of their daily life. Regularity of life was insisted upon, and this was a condition which brought to some of the men a new experience. These facts are mentioned because their recital will help to make clear that, from the standpoint of the men, there were certain depressing

influences connected with the experiment which would add to any personal discomfort caused by restriction of diet.

"The ordinary army ration to which these men were accustomed was rich in proteid, especially in meat, and during the first few days they were allowed to follow their usual dietary habits, in order that data might be obtained bearing on their average food consumption. The details of one day's food intake will suffice to show the average character and amount of the food eaten per man :

BREAKFAST—Beefsteak 222 grams ($7\frac{1}{3}$ oz.), gravy 68 grams ($2\frac{1}{3}$ oz.), fried potatoes 234 grams ($7\frac{2}{3}$ oz.), onion 34 grams (1 oz.), bread 144 grams ($4\frac{2}{3}$ oz.), coffee 679 grams ($22\frac{2}{3}$ oz.), sugar 18 grams ($\frac{2}{3}$ oz).

DINNER—Beef 171 grams ($5\frac{2}{3}$ oz.), boiled potatoes 350 grams ($11\frac{2}{3}$ oz.), onions 55 grams (2 oz.), bread 234 grams ($7\frac{2}{3}$ oz.), coffee 916 grams ($30\frac{1}{2}$ oz.), sugar 27 grams (1 oz.).

SUPPER—Corned beef 195 grams ($6\frac{1}{2}$ oz.), potatoes 170 grams ($5\frac{2}{3}$ oz.), bread 158 grams ($7\frac{2}{3}$ oz.), fruit jelly 107 grams ($3\frac{2}{3}$ oz.), coffee 450 grams (15 oz.), sugar 21 grams ($\frac{2}{3}$ oz.).

"It is not necessary to comment upon the large proportion of proteid matter in the day's ration; the three large portions of meat testify clearly enough to that fact, while the three equally large volumes of coffee indicate a natural disposition toward generous consumption of anything available. Habit, reinforced by inclination, has evidently placed these men on a high plane of food consumption.

"For a period of six months, a daily dietary was prescribed for the subjects; the food for each meal and for every man being of known composition, each article being carefully weighed, while the content of nitrogen in the day's ration was so graded as to bring about a gradual reduction in the amount of proteid ingested. The rate of proteid katabolism [breaking down, opposed to anabolism, or building up] was likewise determined each day by careful estimation of the

excreted nitrogen, balance experiments being made from time to time in order to ascertain if the men were in a condition of nitrogen equilibrium. Finally, it should be mentioned that the subjects lived a fairly active life, having each day a certain amount of prescribed exercise in the university gymnasium, in addition to the regular drill and other duties associated with their usual work.

"As just stated, the amount of proteid food was gradually reduced, three weeks being taken to bring the amount down to a level somewhat commensurate with the estimated needs of the body. This naturally resulted in diminishing largely the intake of meat, though by no means excluding it. Effort was constantly made to introduce as much variety as was possible with simple foods, though the main problem with this group of men was to keep the volume of the food up to such

a point as would dispel any notion that they were not having enough to eat. A second problem, which at first threatened trouble, was the fear of the men, as they saw the proportion of meat gradually drop off, that they were destined to lose their strength; but, fortunately, they very soon began to realize that their fears in this direction were groundless, and a little later their personal experience opened their eyes to possible advantages which quickly drove away all further thought of danger, and made them quite content to continue the experiment."[1]

The following is a sample of the daily meals given to the men after the first month when the amount of their proteid food had been reduced:

APRIL 1

BREAKFAST—Fried hominy 150 grams (5 oz.), syrup 75 grams (2½ oz.), butter 20 grams (⅔ oz.), one cup coffee 350 grams (11⅔ oz.).

[1] Chittenden, "Nutrition of Man," pp. 193–7.

DINNER—Baked spaghetti 200 grams (6⅔ oz.), mashed potato 250 grams (8⅓ oz.), boiled turnip 150 grams (5 oz.), bread 10 grams (⅓ oz.), apple sauce 200 grams (6⅔ oz.), one cup coffee 350 grams (11⅔ oz.).

SUPPER—Fried bacon (⅝ oz.), fried sweet potato 200 grams (6⅔ oz.), bread 35 grams (1⅙ oz.), butter 20 grams (⅔ oz.), jam 100 grams (3⅓ oz.), apple-tapioca pudding 300 grams (10 oz.), one cup tea 350 grams (11⅔ oz.).

Total nitrogen content of the day's food 7,342 grams.

From this sample meal it will be seen that during the last five months of the experiment the men were living on about one-third of the proteid food to which they were accustomed.

"If," says Professor Chittenden, "the relatively small amount of proteid food made use of in this trial was inadequate for the real necessities of the body, some indication of it would be expected to reveal itself, with at least some of the men, by the end of the period. One criticism frequently made is that the subject draws in some measure upon his store of body material. Should this be

the case, it is evident that the body-weight—in such a long experiment as this—will gradually but surely diminish. Further, the subject will show a minus nitrogen balance, i.e. there will be a constant tendency for the body to give off more nitrogen than it takes in. As bearing on the first point, the following table showing the body-weights of the men at the commencement of the experiment in October, and at the close of the experiment in April, will be of interest:

TABLE OF BODY-WEIGHTS

	October, 1903		April, 1904		
	kilos	pounds	kilos	pounds	
Steltz .	. 52·3	115·27	53·0	116·81	
Zooman	. 54·0	119·01	55·0	121·22	
Coffman	. 59·1	130·25	58·0	127·83	
Morris	. 59·2	130·47	59·0	130·03	
Broyles	. 59·4	130·91	61·0	134·44	
Loewenthal	. 60·1	132·46	59·0	130·03	
Sliney	. 61·3	135·10	60·6	133·56	
Cohn .	. 65·0	143·26	62·6	137·97	
Oakman	. 66·7	147·00	62·1	136·86	
Henderson	. 71·3	157·14	71·0	156·48	
Fritz .	. 76·0	167·50	72·6	160·01	
Bates .	. 72·7	160·23	64·3	141·71	(Feb.)
Davis .	. 59·3	130·69	57·2	127·06	(Jan.)

"As is readily seen, five of the men practically retained their weight or made a slight gain. Of the others, Coffman, Loewenthal, Sliney, and Cohn lost somewhat, but the amount was very small. Further, the loss occurred during the first few weeks of the experiment, after which their weight remained practically stationary. Fritz and Oakman lost weight somewhat more noticeably, but this loss likewise occurred during the earlier part of the trial. . . . Of all the men, Bates was the only one who underwent any great loss of weight. He, however, was quite stout, and the work in the gymnasium, reinforced by the change in diet, brought about what was for him a very desirable loss of body-weight. It is evident, therefore, that there was no marked or prolonged loss of body-weight as a result of the continued use of the low-proteid diet." [1]

[1] Chittenden, "Nutrition of Man," pp. 198–200.

Professor Chittenden says that regarding the second point, viz. the nitrogen equilibrium, two different balance experiments with each of the men, one about the first of March and the other a month later, indicated plainly that the men were receiving more proteid food than was necessary to maintain their bodies in nitrogen equilibrium.

"The experiment results presented," says Prof. Chittenden, "afford very convincing proof that, so far as body-weight and nitrogen equilibrium are concerned, the needs of the body are fully met by a consumption of proteid food far below the fixed dietary standards, and still further below the amounts called for by the recorded habits of mankind. General health is equally well maintained, and with suggestions of improvement that are frequently so marked as to challenge attention. Most conspicuous, however,

though something that was entirely unlooked for, was the effect observed on the muscular strength of the various subjects. When the experiments were planned it was deemed important to arrange for careful quantitative tests of the more conspicuous muscles of the body, with a view to measuring any loss of strength that might occur from the proposed reduction in proteid food. The thought that prompted this action was a result of the latent feeling that somehow muscular strength must be dependent more or less upon the proteid constituents of the muscles, and that consequently the cutting down of proteid food would inevitably be felt in some degree. The most that could be hoped for was that muscle tone and muscular strength might be maintained unimpaired. Hence, we were at first quite astonished at what was actually observed.

"With the soldier detail, fifteen distinct strength tests were made with each man during the six months' period, by means of appropriate dynamometer tests applied to the muscles of the back, legs, chest, upper arms and forearms, reinforced by quarter-mile run, vault, and ladder tests, etc. The so-called 'total strength' of the man was computed by multiplying the weight of the body by the number of times the subject was able to push up (strength of triceps muscles) and pull up (strength of biceps muscles) his body while upon the parallel bars, to this product being added the strength (dynamometer tests) of hands, legs, back, and chest. It should be added that all of these tests were made quite independently in the university gymnasium by the medical assistants and others in charge of the work there. It will suffice for our purpose to give here the strength tests

of the various members of the soldier detail at the beginning and close of the experiment:

TOTAL STRENGTH

	October	April
Broyles	2560	5530
Coffman	2835	6269
Cohn	2210	4002
Fritz	2504	5178
Henderson	2970	4598
Loewenthal	2463	5277
Morris	2543	4869
Oakman	3445	5055
Sliney	3245	5307
Steltz	2838	4581
Zooman	3070	5457

"Without exception we note with all of the men a phenomenal gain in strength, which demands explanation. Was it all due to the change in diet? Probably not, for these men at the beginning of the experiment were untrained, and it is not to be assumed that months of practical work in the gymnasium would not result in a certain amount of physical development, with corresponding gain in

muscular skill and power. Putting this question aside for the moment, however, it is surely proper to emphasize this fact, viz. that although the men for a period of five months were restricted to a daily diet containing only one-third to one-half the amount of proteid food they had been accustomed to, there was no loss of physical strength; no indication of any physical deterioration that could be detected. In other words, the men were certainly not being weakened by the lowered intake of proteid food."[1]

In order to ascertain how much of the improvement in the muscular strength, skill and endurance of the soldiers was due to the change in diet alone, as well as to demonstrate the fallaciousness of the old belief that a man doing heavy muscular work requires a large quantity of proteid food, Professor Chittenden

[1] Chittenden, "Nutrition of Man," pp. 202–4.

secured as subjects for his next experiment a group of eight of the leading athletes of the university, all in "training form" and engaged constantly in violent muscular exercise. For five months they lived on a diet comprising not more than one-half to one-third the quantity of proteid food they had been in the habit of eating: as in the case of the soldiers, nitrogenous equilibrium was maintained, the weight, when once adjusted to the new level, remained practically constant, and the gymnasium tests to which they were frequently subjected showed, in every man, a truly remarkable gain in strength and endurance.

"Naturally," says Professor Chittenden, "in the case of these men the gain in strength recorded cannot be assigned to systematic training. The only change in their mode of living which can in any sense be considered as responsible

for the improvement is the change in diet.

"The main fact to be emphasized, however, is that these men—trained athletes, accustomed to living on relatively large amounts of proteid food—for a period of five months reduced their intake of proteid food more than 50 per cent without loss of bodily strength, but, on the contrary, with a marked improvement in muscular power."[1]

Convincing as these experiments may seem to the average lay mind they did not meet the old argument, drawn from certain experiments upon dogs, that high-proteid animals cannot live and thrive for any great length of time on the low-proteid diet, and that, therefore, while man, as a moderate proteid-eater, can endure for a while even large reduc-

[1] Chittenden, "Physiological Economy in Nutrition," p. 438.

tions in proteid food he will eventually manifest some of the disastrous results obtained experimentally with dogs.

Therefore Professor Chittenden's next step was to demonstrate that these old experiments proved nothing at all except that any animal will not thrive if kept in close confinement under unhygienic conditions and fed on a monotonous diet. Accordingly the twenty dogs used in his experiment were kept under scrupulously hygienic conditions and fed on a diet sufficiently varied to be tempting to the appetite, although containing only about one-half to one-third the amount of proteid food to which the dogs had been accustomed.

Professor Chittenden's account of his observations on one of his subjects is as follows :

"The animal employed in this experiment weighed on July 27, 1905, 17·2

kilograms (37·9 pounds); it was apparently full grown, but was thin and had the appearance of being underfed. At first it was given daily 172 grams ($5\frac{2}{3}$ oz.) of meat, 124 grams ($4\frac{1}{6}$ oz.) of cracker dust, and 72 grams ($2\frac{1}{3}$ oz.) of lard, the day's ration containing 8·66 grams of nitrogen and having a fuel value of 1389 calories.[1] These figures

[1] "A calorie may be defined as the amount of heat required to raise one gram of water 1 degree C. This unit is usually spoken of as the small calorie to distinguish it from the large calorie, which represents the amount of heat required to raise one kilogram of water 1 degree C. Hence, the large calorie is equal to one thousand small calories. When burned in a calorimeter, one gram of carbohydrate yields on an average 4100 gram-degree units of heat, or small calories; one gram of fat yields 9300 small calories. Both of these non-nitrogenous foods burn or oxidize to the same products—viz. carbon dioxide and water—when utilized in the body as when burned in the calorimeter; hence the figures given represent the physiological heat of combustion, per gram, of the two classes of food stuffs. Obviously, the fuel values of different foods belonging to the same group or class will show slight variations, but the above figures represent average values."—Chittenden, "Nutrition of Man," p. 14.

are equivalent to 80 calories, and 0·50 gram of nitrogen, per kilogram (2·204 pounds) of body-weight. The animal took kindly to the diet, but on August 3 it refused to eat and seemed to have a little fever. The next day it was better, but for the three following days its appetite was poor, and only a portion of the daily food was eaten. Body-weight began to fall off, and was soon at 15·5 kilograms (34·16 pounds). On the 7th of August, a dose of vermifuge was given, after which the appetite returned and the animal appeared in good spirits. From this time forward it seemed in perfect health, with good appetite, and showed the usual vivacity and playfulness of dog-kind. The diet as specified was continued unchanged until August 25, a balance experiment covering a period of ten days, from the 15th to the 24th of August inclusive, being carried out, in

which the nitrogen of the intake was compared with the output for each day. . . . During this first period the animal was laying on or gaining an average of 2 grams of nitrogen per day.

"On August 25, a radical change was made in the diet, by reducing the amount of meat to 70 grams ($2\frac{1}{3}$ oz.) daily, thereby lowering the intake of nitrogen to 4·76 grams or 0·27 gram per kilo of body-weight; the cracker dust and lard being kept at essentially the same levels as before. This diet was continued through the next balance period, the dog in the meantime gaining in body-weight, and showing for the second balance period an average gain by the body of half a gram of nitrogen per day. The food was then altered by substituting bread for cracker dust, but so adjusted that the nitrogen and fuel values of the day's food remained practically unchanged. There

was still, however, a gain in body-weight and a slight gain in body nitrogen. At the close of the third balance period, the diet was again altered, one-half of the meat being replaced by milk, while cracker dust was substituted for the bread. The morning meal consisted of 170 grams ($5\frac{2}{3}$ oz.) of milk, 86 grams (3 oz.) cracker dust, and 18 grams ($\frac{2}{3}$ oz.) of lard, while the afternoon meal was composed of 35 grams ($1\frac{1}{6}$ oz.) of meat, 63 grams (2 oz.) of cracker, and 35 grams ($1\frac{1}{6}$ oz.) lard. The day's ration, however, still contained 4·76 grams of nitrogen and had a fuel value of 1249 calories. This diet was maintained until November 20, when the animal was again placed on a daily ration of meat 69 grams ($2\frac{1}{3}$ oz.), bread 166 grams ($5\frac{1}{2}$ oz.), and lard 80 grams ($2\frac{2}{3}$ oz.) with a total fuel value of 1228 calories and 4·77 grams of nitrogen. This was continued until December 2,

the dog still showing a plus nitrogen balance, but with a little loss in body-weight. On December 2, the diet was again changed by substituting milk for a portion of the meat, but the nitrogen and fuel values were maintained at the same level as before. After a week, December 9, the food was modified as follows: the morning meal contained 170 grams ($5\frac{2}{3}$ oz.) of milk, 110 grams ($3\frac{2}{3}$ oz.) of rice, and 11 grams ($\frac{1}{3}$ oz.) of lard; while the afternoon meal was composed of 35 grams ($1\frac{1}{6}$ oz.) of meat, 81 grams ($2\frac{2}{3}$ oz.) of rice, and 30 grams (1 oz.) of lard. The total nitrogen content of the day's ration was 4·07 grams, while the fuel value was 1255 calories. At this time, the animal weighed 17·1 kilograms (37·68 pounds), consequently the intake of nitrogen had been reduced to 0·23 gram per kilo of body-weight, while the fuel value stood at 73 calories per

kilogram. This diet was continued until February 9, the balance period, between January 2 and 11, showing that the animal was in nitrogen equilibrium, in spite of the material reduction in the intake of proteid, and that body-weight was increasing. The next balance period, January 30 to February 8, showed still further gain in weight with continuance of nitrogen equilibrium. On February 9, the diet was changed by returning to 70 grams (2½ oz.) of meat, 158 grams (5⅓ oz.) of cracker dust, and 60 grams of lard, with a daily intake of 0·28 gram of nitrogen per kilo of body-weight.

"In this manner, the experiment was continued with frequent changes in the character of the diet, but always maintaining essentially the same value in nitrogen and calories as shown in the table, until June 27; having extended

through just eleven months, with the animal at the close of the experiment still gaining in body-weight, with a steady plus balance of nitrogen, and with every indication of good health and strength. For ten months the animal lived with perfect comfort and in good condition on an average daily intake of 0·26 gram of nitrogen per kilogram of body-weight, and with an average fuel value of 70·3 calories per kilo. Further, it is to be observed that at no time during the ten months did the daily intake of nitrogen rise above 0·28 gram per kilo, while during one month it fell 0·23 gram per kilo.

"Similarly the fuel value of the daily food never exceeded 73 calories per kilo, while at times it dropped as low as 67 and 65 calories per kilo. That this diet was more than sufficient, both in nitrogen and fuel value, is indicated by the steady

increase in body-weight and by the plus nitrogen balance observed in most of the periods throughout the experiment. Indeed, with the comparatively low degree of muscular activity which this animal was accustomed to, it would have been unwise to have kept the subject much longer on a diet so rich as the above, since there would have been danger of detriment to its health and good condition." [1]

Professor Chittenden's conclusion from these experiments is as follows: "These experiments on the influence of a low-proteid diet on dogs, as a type of high-proteid consumers, taken in their entirety, afford convincing proof that such animals can live and thrive on amounts of proteid and non-nitrogenous food far below the standards set by Munk and Rosenheim. The deleterious results reported by these

[1] Chittenden, "Nutrition of Man," pp. 244–8.

investigators were not due to the effects of low proteid or to diminished consumption of non-nitrogenous foods, but are to be ascribed mainly to non-hygienic conditions, or to a lack of care and physiological good sense in the prescription of a narrow dietary not suited to the habits and needs of this class of animals. Further, it is obvious that the more or less broad deductions so frequently drawn from the experiments of Munk and Rosenheim, especially in their application to mankind, are entirely unwarranted and without foundation in fact. Our experiments offer satisfying proof that not only can dogs live on quantities of proteid food per day smaller than these investigators deemed necessary, and with a fuel value far below the standard adopted by them; but, in addition, that these animals are quite able on such a diet to gain in body-weight and to lay by nitrogen,

thereby indicating that even smaller quantities of food might suffice to meet their true physiological requirements."[1]

Further experimental evidence in the investigation of both Mr. Fletcher's claims for mastication and Professor Chittenden's claims for a deliberately restricted proteid diet has been contributed by Professor Irving Fisher, professor of political economy at Yale, who, as a political economist, has been interested in testing the alleged effect of the new system of diet upon a man's output of work.

Professor Fisher's first experiment was upon nine Yale students, in vigorous health and of ordinary student occupations, and lasted twenty weeks. The men were instructed to follow their own tastes in choosing the character and amount of the food taken, but were asked not to eat until they were equally hungry,

[1] Chittenden, "Nutrition of Man," pp. 263-4.

and then to masticate both solid and liquid food until it was involuntarily sucked down into the throat.

The experiment is thus described by Professor Fisher:

"Two years later" (than the experiments upon Mr. Fletcher), "in 1906, nine Yale students under my direction experimented with Mr. Fletcher's method of instinctive eating. Careful records were taken of the amounts of food consumed and the proportions of proteid, fat and carbohydrate (starch and sugar) used. In order to avoid the annoyance of weighing the food at the table it was all weighed in the kitchen and served in definite portions of known food value. From these records the proportions of proteid, fat and carbohydrate were worked out by means of a Mechanical Diet Indicator, which I have described in *The American Journal of Physiology* and

The Journal of the American Medical Association. Records were made for each man and each day during the five months of the experiment. It was found that the proteid element was gradually and unconsciously reduced. During the second half of the experiment this reduction was somewhat accelerated by suggesting to the men that when appetite was in doubt they should give the benefit of that doubt to low-proteid non-flesh foods: but the men were never encouraged to choose any food when their instinct definitely preferred another.

"The main lesson from the experiment, however, was that the men improved in health and physical endurance. By actual gymnasium tests it was found that the physical endurance of the men was approximately doubled in five months. . . . Only one of the men failed to improve in endurance, and this exception proved

the rule, for he was the only one of the nine who was not thorough in his practice of mastication, nor did he, in consequence, reduce his flesh foods as much as did the other experimenters. The majority of the men who took part in the experiment have become enthusiastic, have continued to 'Fletcherize,' and have taken up physical culture in all of its branches."[1]

A previous experiment made by Professor Fisher with a number of meat-eaters and vegetarians showed that "those who ate little or no flesh foods have greater endurance than those who use flesh foods in abundance"[2]—a fact which also tends to uphold the argument for the merits of a low-proteid diet.

Both Professor Chittenden's and Professor Fisher's experiments lead to the

[1] Fisher, *The Independent.* New York, August, 1907.

[2] Fisher, "The Influence of Flesh-eating on Endurance."

same conclusion—i.e. that man can live and thrive on from one-half to one-third of the amount of food prescribed by the so-called "standard" dietaries; and in the author's opinion seem to confirm, without scientifically proving, Mr. Fletcher's claim that, by the practice of complete mastication, the amounts of food demanded by the appetite may be brought naturally into conformation with these true physiologic needs.[1]

[1] For the convenience of the reader, the terms of the metric system used by Professor Chittenden in designating the amounts of food, etc., used in his experiments, have been indicated in terms of the avoirdupois system.

CHAPTER II

Topics: Composition of foods. Purposes served by the various food elements. Digestion. Changes occurring in the mouth. New discoveries in regard to saliva. The effect of mastication upon the digestive process. Taste and appetite as stimuli of the digestive secretions. Other psychic influences in digestion. Assimilation. Poisonous properties of the body-waste. Metabolism. Quantities of food necessary to the maintenance of physical efficiency. The old dietary standards. The new standards.

IN order that the argument that follows may be readily understood, it is desirable that the reader should have a general working knowledge of the chemical composition of his foods, of the several purposes which the various food elements serve in the bodily economy, and of the different processes by which these purposes are accomplished.

All foods, whether animal or vegetable, are made up of three distinct classes of

organic compounds known as proteid or nitrogenous or albuminous substances, carbohydrates and fats; and of some fifteen different inorganic salts.[1] Of these the proteid substances hold the first place. They form the chemical basis of all living cells, and without them, there can be no life. They are the material which builds the body, which ensures growth and which repairs tissue broken down by muscular exercise.

"The vital part of all tissue is proteid," says Professor Chittenden, "and only proteid can serve for its growth or renewal. . . . Every living cell, whether

[1] NOTE.—Proteid substances are characterized by containing about 16 per cent of nitrogen. In addition, they contain on an average 52 per cent of carbon, 7 per cent of hydrogen, 23 per cent of oxygen, and 0·5–2·0 per cent of sulphur. . . . Carbohydrates . . . are entirely free from nitrogen, containing only carbon (44·4 per cent), hydrogen (6·2 per cent), and oxygen (49·4 per cent), and hence are classified as non-nitrogenous foods.—"Nutrition of Man," pp. 3–5.

of heart, muscle, brain or nerve, requires its due allowance of proteid material to maintain its physiological rhythm. No other foodstuff stands in such intimate relationship to the vital process."[1]

As has been said before, the foods which contain the highest percentages of proteid and which, therefore, are known as "proteid foods," are meat, fish, eggs, nuts, peas, beans, lentils and cheese; but there is no article of human diet except sugar and pure fat into which it does not enter in a greater or less degree. Other things being equal, proteid seems to serve its purpose in the bodily economy equally well whether derived from the animal or from the vegetable kingdom.

The carbohydrates and fats furnish the fuel for the body. They yield the heat that keeps it warm and the energy that

[1] Chittenden, "Nutrition of Man," pp. 4–5.

enables it to do its work. While they are incapable of adding to the lean tissue without which the body cannot exist, they are able—when taken in excess of immediate fuel needs—to lay up a store of fat which the body can draw upon for its heat and energy whenever its food supply is cut off.

The carbohydrates are found chiefly in grains; in vegetables (other than peas, beans and lentils); and in fruits. All sweets and all "starchy" foods—of which the sweets are really only a form—belong to this class. For this reason the carbohydrates are frequently called "the starches and sugars."

Fats are found in almost all the proteid foods. There is no meat that is not streaked with them to a greater or less extent, and nuts are generously supplied with them in the form of oil. Of all the vegetables the "fattest" are

the "legumes"—peas, beans, lentils and peanuts. Cheese is almost as rich in fat as it is in proteid. About the only foods which are prized primarily for their fats are butter and vegetable oils.

Inorganic salts are required by the body for the building of bones and teeth, and for the regulation and control of the nutritive processes. They cannot build live tissue or furnish heat and energy, but they are essential as aids to digestion and assimilation. They are contained in all forms of food, but they exist in the vegetables in the greatest number and variety.

The following table, compiled by Professor Chittenden from data given in Bulletin 28 (Revised Edition) of U.S. Department of Agriculture indicates the relative distribution of the various classes of food elements in some common articles of diet.

THE CHEMICAL COMPOSITION OF SOME COMMON FOOD MATERIALS[1]

FOOD MATERIALS.	Proteid per cent.	Carbo-hydrates per cent.	Fat per cent.	Water per cent.	Mineral Matter per cent.	Fuel Value per pound calories.
Cooked beef roasted	22·3	0	28·6	48·2	1·3	1620
Cooked round steak	27·6	0	7·7	63·0	1·8	840
Tenderloin steak broiled	23·5	0	20·4	5·48	1·2	1300
Dried beef, canned	39·2	0	5·4	44·8	11·2	960
Stewed kidneys canned	18·4	2·1	5·1	71·9	2·5	600
Lamb chops broiled	21·7	0	29·9	47·6	1·3	1665
Roast leg lamb	19·4	0	12·7	67·1	0·8	900
Roast leg mutton	25·9	0	22·6	50·9	1·2	1420
Smoked ham, fat	14·8	0	52·3	27·9	3·7	2485
Roast turkey	27·8	0	18·4	52·0	1·2	1295
Fricasseed chicken	17·6	2·4	11·5	67·5	1·0	855
Broiled Spanish mackerel	23·2	0	6·5	68·9	1·4	715
Tinned salmon	21·8	0	12·1	63·5	2·6	915
Tinned sardines	23·0	0	19·7	52·3	5·6	162
Fresh round clams	6·5	4·2	0·4	86·2	2·7	215
Fresh oysters	6·0	3·3	1·3	88·3	1·1	230
Boiled eggs	13·2	0	12·0	73·2	0·8	765
Butter	1·0	0	85·0	11·0	3·0	3605
Full cream cheese	25·9	2·4	33·7	34·2	3·8	1950
Milk	3·3	5·0	4·0	87·0	0·7	325
Boiled rice	2·8	24·4	0·1	72·5	0·2	525

[1] Chittenden, "Nutrition of Man," pp. 7–10

THE CHEMICAL COMPOSITION OF SOME COMMON FOOD MATERIALS[1]—*continued*

FOOD MATERIALS.	Proteid per cent.	Carbo-hydrates per cent.	Fat per cent.	Water per cent.	Mineral Matter per cent.	Fuel Value per pound calories.
Brown bread	5·4	47·1	1·8	43·6	2·1	1050
Wheatbread rolls	8·9	56·7	4·1	29·2	1·1	1395
Wholewheat bread	9·4	49·7	0·9	38·4	1·3	1140
Soda biscuits	9·8	73·1	9·1	5·9	2·1	1925
Gingerbread	5·8	63·5	9·3	18·8	2·9	1670
Lady fingers	8·8	70·6	5·0	15·0	0·6	1685
Sponge cake	6·3	65·9	10·7	15·3	1·8	1795
Apple pie	3·1	42·8	9·8	42·5	1·8	1270
Tapioca pudding	3·3	28·2	3·2	64·5	0·8	720
Cooked beets	2·3	7·4	0·1	88·6	1·6	185
Dried peas	24·6	62·0	1·0	9·5	2·9	1655
Boiled potatoes	2·5	20·9	0·1	75·5	1·0	440
Fresh tomatoes	0·9	3·9	0·4	94·3	0·5	105
Baked beans, tinned	6·9	19·6	2·5	68·9	2·1	600
Apples	0·4	14·2	0·5	84·6	3·0	290
Bananas, yellow	1·3	22·0	0·6	75·3	0·8	460
Oranges	0·8	11·6	0·2	86·9	0·5	240
Peaches	0·7	9·4	0·1	89·4	0·4	190
Strawberries	1·0	7·4	0·6	90·4	0·6	180
Almonds	21·0	17·3	54·9	4·8	2·0	3030
Peanuts	25·8	24·4	38·6	9·2	2·0	2560
Pine nuts	33·9	6·9	49·4	6·4	3·4	2845
Brazil nuts	17·0	7·0	66·8	5·3	3·9	3265
English walnuts	16·6	16·1	63·4	2·5	1·4	3285

[1] Chittenden, "Nutrition of Man," pp. 7–10.

In using this table, the fact should be borne in mind that foods containing equal quantities of the various food elements are not necessarily, because of their varying degree of digestibility, of equal food value. "For example," says Professor Chittenden, "roast mutton, cream cheese, and dried peas contain approximately the same amount of proteid. Are we to infer that these three foods have the same nutritive value so far as proteid is concerned? Surely not, since no account is taken of the relative digestibility of the three foods. . . . In a general way it may be stated that with animal foods, such as meats, eggs, and milk, about 97 per cent of the contained proteid is digested and thereby rendered available for the body. With ordinary vegetable foods, on the other hand, as they are usually prepared for consumption, only about 85 per cent of the proteid is made

available. This is partially due to the presence in the vegetable tissue of cellulose, which in some measure prevents that thorough attack of the proteid juices which occurs with animal foods. With a mixed diet, i.e. with a variable admixture of animal and vegetable foods, it is usually considered that about 92 per cent of the proteid contained therein will undergo digestion.

"Regarding differences in the availability of fats, it may be stated that, as a rule, the fatty matter contained in vegetable foods is less readily, or less thoroughly, digested than that present in foods of animal origin. In the latter, about 95 per cent of the fat is digested and absorbed. This figure, however, is generally taken as representing approximately the digestibility or availability of the fat contained in man's daily dietary, since by far the larger proportion of the

fat consumed is of animal origin. Carbohydrates, on the other hand, are much more easily utilized by the body. Naturally, sugars, owing to their great solubility and ready diffusibility, offer little difficulty in the way of easy digestion; but starches likewise, though not so readily assimilable, are digested, as a rule, to the extent of 98 per cent or more of the amount consumed."[1]

Before food taken into the body can be built up into living tissue or made to yield its content of heat and energy, it must first undergo the process of digestion. This process—contrary to the ideas of the old physiologists who thought that digestion began in the stomach—is now known to have its inception in the mouth. Saliva—once believed to be chiefly useful in rendering foods soft and

[1] Chittenden, "Nutrition of Man," pp. 12-13.

moist enough to pass easily down the esophagus—is now known to be one of the most powerful digestive juices secreted by the body ; and the act of mastication—once thought to serve the somewhat insignificant purpose of breaking up the food into particles small enough to be swallowed—is now known to perform a number of important offices in the work of digestion. The first of these is to accelerate the flow of saliva and to increase its digestive power by heightening its alkalinity.

This is of the very highest importance to the digestion of the whole great class of foodstuffs known as carbohydrates. While the saliva has no appreciable chemical effect upon the fats and proteids, it is capable of practically completing the digestion of the starches and sugars—if they are retained in the mouth long enough and subjected to sufficient

mastication—before they are swallowed into the stomach.

"Need we comment, in view of the natural brevity of this process," says Professor Chittenden, "upon the desirability for purely physiological reasons of prolonging within reasonable limits the interval of time the food and saliva are commingled in the mouth cavity? It seems obvious, in view of the relatively large bulk of starch-containing foods consumed daily, that habits of thorough mastication should be fostered, with the purpose of increasing greatly the digestion of starch at the very gateway of the alimentary tract. It is true that in the small intestine there comes later another opportunity for the digestion of starch; but it is unphysiological, as it is undesirable, for various reasons, not to take full advantage of the first opportunity which Nature gives for the preparation

of this important foodstuff for future utilization. Further, thorough mastication, by a fine comminution of the food particles, is a material aid in the digestion which is to take place in the stomach and intestine. Under normal conditions, therefore, and with proper observance of physiological good sense, a large proportion of the ingested starchy foods can be made ready for speedy absorption and consequent utilization through the agency of salivary digestion."[1]

Dr. Harry Campbell,[2] of the North-West London Hospital, says:

"The saliva has apparently no effect on fats; whether it acts on proteids seems more doubtful, though by some authorities the penetration of these by the alkali of this fluid is said to aid in

[1] Chittenden, "Nutrition of Man," p. 23.

[2] Campbell: Lecture quoted in "The A. B.—Z. of Our Own Nutrition," pp. 101–2.

their subsequent digestion; on starch, however, the saliva acts very potently, and hence mastication plays a special part in promoting the digestion of starchy foods. Indeed, if only mastication be persisted in long enough, starch may be wholly converted into maltose (a form of sugar) within the mouth. . . . Provided they be sufficiently insalivated, there are few starchy foods that are indigestible, not even excepting the proverbially indigestible new potato."

The chief factors in the production of salivary flow—aside from the mechanical movements of chewing—are the thought, taste, sight, and smell of tempting food. "The secretory centre may be stimulated, and likewise inhibited, in impulses which have their origin in higher nerve centres in the brain," says Professor Chittenden. ". . . The thought and the odour of savoury food cause the mouth to water.

Similarly, fear, embarrassment, and anxiety frequently cause a dry mouth and parched throat. . . . The application of these facts to our subject is perfectly obvious, since they suggest at once how the production of an important digestive fluid—upon which the utilization of a given class of foodstuffs may be quite dependent—is controlled and modified through the nervous system by a variety of circumstances. We might reason that the appearance, odour, and palatability of food are factors of prime importance in its utilization by the body; and that the æsthetics of eating are not to be ignored since they have an important influence upon the flow of the digestive secretions. A peaceful mind, pleasurable anticipations, freedom from care and anxiety, cheerful companionship, all form desirable table accessories which play the part of true psychical stimuli

in accelerating the flow of the digestive juices and thus pave the way for easy and thorough digestion."[1]

In the stomach the saliva continues its digestive activity until it is brought in contact with the gastric juice. This fluid, being an acid, promptly neutralizes the effect of the alkaline saliva, and checks temporarily the further digestion of the starchy foods. Therefore it is easy to understand that, as Dr. Harry Campbell[2] points out:—

"Mastication increases the amount of alkaline saliva passing into the stomach, and this not only prolongs the period of starch digestion within this organ, but, by its influence upon the reaction of the gastric contents, influences all the digestive processes taking place there."

[1] Chittenden, "Nutrition of Man," pp. 18–19.

[2] Campbell: Lecture quoted in "The A. B.—Z. of Our Own Nutrition," p. 102.

When the action of the saliva has been ended, the gastric juice takes up the work of digesting the fats and proteids. As in the case of saliva, the scientists have been finding out some new things in regard to this fluid which have greatly modified their ideas in regard to the whole subject of nutrition. It was formerly thought that the secretion of gastric juice was caused by the contact of the food with the stomach walls. A short time ago, however, Professor J. P. Pavlov, director of the Department of Experimental Physiology in the Russian Military School of Medicine at St. Petersburg, by a series of experiments upon dogs, established positively that the flow of gastric juice was caused primarily, not by contact of the food with the stomach-walls, but by a keen desire for food and by the pleasure of eating it—that is, by appetite and taste.

"Pavlov has clearly shown," says Professor Chittenden, "that the gastric juice is started by impulses which have their origin in the mouth and nostrils; the sensation of eating, the smell, sight, and taste of food serving as psychical stimuli, which call forth a secretion from the stomach glands, just as the same stimuli may induce an outpouring of saliva. These sensations, as Pavlov has asserted, affect secretory centres in the brain, and impulses are thus started which travel downward to the stomach through the vagus nerves, and as a result gastric juice begins to flow."[1]

The first and most powerful exciter of the secretory nerves of the stomach, therefore, is the appetite. After appetite, the chief agent for the production of gastric juice is a keen sense of the pleasant taste of food. As the finer degrees of

[1] Chittenden, "Nutrition of Man," pp. 23–4.

appreciation can be achieved only when food is finely divided, subjected to the transforming action of saliva, and passed slowly over the "taste-buds" in the mouth, it can readily be seen that mastication plays an important part in this process.

"The mere chewing of food," says Dr. Daniel S. Sager, "is sufficient to cause an abundant flow of gastric juice. The longer the food is held in the mouth, the greater the impression made on the nerves of taste. Through these nerves the appetite centre is stimulated, and from this centre are sent out to the stomach powerful nervous impulses which excite the glands to activity whereby powerful appetite juice is produced. When food is swallowed quickly, its various flavours are little appreciated. The excitation produced is of no consequence, and the amount of juice secreted will be

very small; whereas if the food is retained in the mouth and masticated until every particle of sapid substance is extracted from it, there is an abundant flow of juice and the greatest good is derived from it. When food is eaten in the ordinary hasty manner, the taste is swallowed with it, the palate is stimulated only to a very moderate extent, very little appetite juice is produced, and digestion fails in consequence."[1]

Dr. Harry Campbell says: "It is now known that mastication acts reflexly upon the stomach, promoting the flow of gastric juice, and thus preparing the stomach for the entrance of the food into it. Food introduced into the stomach, unaccompanied by mastication, is less effective in promoting the gastric flow. It is probable that the influence of mastication on the

[1] Sager, "The Art of Living in Good Health," pp. 23–4.

flow of gastric juice is largely produced through the medium of psychic influences, for the more efficient the mastication, the more is the sense of taste affected."[1]

As in the case of saliva, the gastric secretions are stimulated by pleasure and checked by distress. Through observations on animals by means of the Röntgen Ray, scientists have been able actually to watch this law at work. By mixing with the food a small quantity of subnitrate of bismuth, a tasteless substance which is opaque to the Röntgen Ray, Dr. W. B. Cannon, of the physiological laboratory of the Harvard Medical School, showed by ocular demonstration, that as long as the subject of the experiment, a female cat, was kept happy and comfortable, the food passed rapidly and rhythmically along the digestive tract, but as soon as

[1] Campbell: Lecture quoted in "The A. B.—Z. of Our Own Nutrition," pp. 102–3.

the cat was hurt or annoyed, the movements stopped short and the food remained stationary until the cat was once more made comfortable or restored to a good humour.[1]

As food is brought into proper condition by the stomach, it is permitted to pass gradually into the small intestine where digestion is completed and the absorption of the prepared food material into the blood is begun.

"The intestine," says Professor Chittenden, "is a much more important part of the alimentary tract" (than the stomach); "it is likewise far more sensitive to changing conditions than the stomach, and undoubtedly one function of the latter organ is to protect the intestine and preserve it from insult. The stomach may be compared to a

[1] See Lectures of Dr. W. B. Cannon: "The A. B.—Z. of Our Own Nutrition," pp. 285–388.

vestibule or reservoir, capable of receiving without detriment moderately large amounts of food, together with fluid, in different forms and combinations, with the power to hold them there until by action of the gastric juice they are so transformed that their onward passage into the intestine can be permitted with perfect safety. Then, small portions of the properly prepared material may be discharged from time to time through the pylorus (the outlet of the stomach into the intestine) without danger of overloading the intestine, and in a form capable of undergoing rapid and complete digestion. Further, the stomach as a reservoir is very useful in bringing everything to a proper and constant temperature before allowing its entry into the intestine. . . . The great bulk of the digested food material is absorbed from the small intestine, and there are two

pathways open through which the absorbed material can gain access to the blood. The one path leads directly to the liver, and substances taking this course are exposed to the action of this organ before they enter into the general circulation. The other path is through the lacteal or lymphatic system, and constitutes a roundabout way for substances to enter the blood stream, since they must first pass through the thoracic duct before entering the main circulation. As a general truth, it may be stated that fats are absorbed through the latter channel, while carbohydrates and proteids follow the first path. The innumerable blood capillaries in the villi of the intestine take up the products resulting from the digestion of proteids and carbohydrates, through which they are passed into the portal vein, and thereby distributed throughout the liver. This

means that both carbohydrates and proteids—or their decomposition products—are exposed to a variety of possible changes in this large glandular organ, before they can enter into the tissues of the body." [1]

The residue of the food material which reaches the large intestine is made up chiefly of waste products, which are more or less a source of danger to the body, since, before being excreted, they are attacked by bacteria and broken down by the process of putrefaction into poisonous or "toxic" substances. These substances, passing into the blood and lymph through the walls of the intestine, are distributed throughout the entire system, where they give rise to the condition known as "auto-intoxication" or self-poisoning. Scientists nowadays are giving a great deal of attention to this phenomenon. Elie

[1] Chittenden, "Nutrition of Man," pp. 30-45.

Metchnikoff, of the Pasteur Institute at Paris, has actually suggested the possible advantage of removing some eighteen feet of the intestine by surgical operation to save the body from the evil effects of the decomposing waste products stored in its convoluted folds; or, since this seems hardly a practical measure, the drinking of certain properly prepared kinds of sour milk, which, it seems, is endowed with certain properties that are capable of killing off the intestinal bacteria.[1] Physicians, recognizing the truth of Metchnikoff's claims for sour milk, but knowing also that they could never get their patients to adopt it as an article of diet, have learned how to take the bacteria-killing principle out of the milk and adapt it for administration in the form of medicine. The leaders of modern

[1] Elie Metchnikoff, "The Nature of Man," p. 70. London, William Heinemann.

medicine and modern physiology alike seem to be impressed with the dangers to the body arising from the waste products in the lower intestines and with the necessity of finding some means of doing away with these dangers.

After having been digested and absorbed, food must be "metabolized" —that is to say, built up into living tissue or broken down into excretory products with liberation of heat and energy.

The digested food material, after having been absorbed into the blood and lymph, is circulated throughout the entire body. As it passes along, the tissues seize upon whatever they need of proteid, carbohydrates or fats—and proceed to build it up into living tissue. However, even after the tissues have taken up all the materials they need both for repairs and for growth, a cer-

tain amount of food material is still left floating about in the blood and lymph. This material coming into contact with the oxygen furnished to the blood by the lungs is "oxidized"—that is to say it is literally burned up, and as it burns it gives off the heat and energy that results from any form of combustion.

The first of these processes is known as "anabolism," or building up, and the second as "katabolism," or breaking down; but they are both comprehended under the broad term "metabolism"—which is applied to all the chemical changes that take place in living tissue.

During this process certain decomposition products are formed which must be excreted through the lungs, skin or kidneys or they become a menace to the well-being of the organism. Professor Chittenden says: "The human body is a

maelstrom of chemical changes; chemical decompositions are taking place continuously at the expense of the proteids, fats and carbohydrates of the tissues and of the food, the stored-up energy of these organic compounds being thereby transformed into the active, or kinetic, forms of heat and motion; while carbon dioxide, water, urea and some few other nitrogenous substances are being continually formed as the normal waste products of these tissue changes, and constantly or intermittently excreted. In other words, the body is in a perpetual condition of chemical oscillation, constantly consuming its own substance, rejecting the waste products which result, and giving off energy in the several forms characteristic of living beings."[1]

It is therefore of the highest importance that the body should maintain an

[1] Chittenden, "Nutrition of Man," pp. 77–8.

even balance between its income and its outgo. If it continually pays out more than it takes in, its stores become exhausted and it starves. If, on the other hand, it takes in more than it gives out, the excess of food material is deposited in the tissues as cumbersome fat, or else the whole bodily organism is whipped up to abnormal exertions to get the oversupply out of the way. In either event, the body suffers—from overfeeding even more than from underfeeding.

"It is self-evident," says Professor Chittenden, "that the smallest amount of food that will serve to keep the body in a state of high efficiency is physiologically the most economical and hence the best adapted to the needs of the organism."[1]

For many years the dietary standard

[1] Chittenden, "Physiological Economy in Nutrition," p. 8.

of Carl Voit, the famous Munich physiologist, has been accepted as giving the minimum food requirements for a healthy man. This standard calls for 118 grams or 4 ounces of proteid, 56 grams or two ounces of fat, and 500 grams or $16\frac{2}{3}$ ounces of carbohydrates with a total fuel value of 3,055 large calories[1] daily for a man doing moderate work. For a man doing hard work, the daily requirement is increased to 145 grams or $4\frac{5}{6}$ ounces of proteid, 160 grams or $5\frac{1}{3}$ ounces of fat, and 450 grams or 15 ounces of carbohydrates with a fuel value of 3,370 large calories.

A more recent investigator, Professor W. O. Atwater, places the daily requirement for proteid at 125 grams or $4\frac{1}{6}$ ounces, with sufficient fats and carbohydrates to give a total fuel value of 3,500 large calories for a man doing

[1] Chittenden, "Nutrition of Man," pp. 98–9.

moderate work; while for a man at hard work he increases the daily diet to 150 grams or 5 ounces of proteid, with fats and carbohydrates to yield a total fuel value of 4,500 large calories.

Through his experiments Professor Chittenden has shown conclusively that mental and bodily vigour are maintained and even tend to be greatly increased on a much smaller quantity of all classes of foods, but of proteid foods in particular, than are called for by these standards. Furthermore, he has shown that not only is there no advantage in the consumption of these quantities of food, but that their presence in the body may be directly injurious.

In the first place, Professor Chittenden's experiments indicate that, contrary to general opinion, the body cannot lay up flesh—that is, lean meat—by the consumption of large quantities of pro-

teid. "It is generally considered as a settled fact," he says, "that in man it is impossible to accomplish any large permanent storing or deposition of flesh by overfeeding. Similarly, it is understood, that the muscular strength of man cannot be greatly increased by an excessive intake of food. The only conditions under which there is ordinarily any marked and permanent flesh deposition are such as are connected with the regenerative energy of living cells. Thus, as von Noorden has stated, an accumulation or storing of tissue proteid is seen especially in the growing body, where new cells are being rapidly constructed; also in the adult where growth may have ceased, but where increased muscular work has resulted in an hypertrophy or enlargement of the muscular tissue; and lastly in those cases where, owing to previous insufficient food or to the wast-

ing away of the body incidental to disease, the proteid content of the tissues has been more or less diminished, and consequently an abundance of proteid food is called for and duly utilized to make good the loss."[1]

The experiments seem to prove conclusively that the intake and outgo of nitrogen—the important element of proteid—tend to run in exactly parallel lines—that is to say, that "increase of proteid income is followed at once by an increase in the metabolism of proteid with a corresponding outgo of nitrogen."[2]

"A meal rich in proteid leads at once —within a few hours," he says, "to an excretion of urea equivalent to full 50 per cent of the nitrogen of the ingested proteid, while a few hours later finds practically all the nitrogen of the intake

[1] Chittenden, "Nutrition of Man," p. 131.
[2] *Ibid.*, p. 151.

eliminated from the body. Further, it is to be remembered that in a general way this occurs no matter what the condition of the body may be at the time and no matter how large or small the amount of proteid consumed. In other words, there is practically no appreciable storing of nitrogen or proteid for future needs—at least none that is proportional to the increase in nitrogen intake, even though the body be in a condition approximating to nitrogen starvation."

Therefore all but the very small quantity of proteid food that is required by the tissues for development or repairs is left floating in the blood along with the other food material which is to be oxidized for the furnishing of heat and energy. Professor Chittenden questions whether this can be regarded as an advantage. "We all recognize that an excessive accumulation of fat is distinctly

disadvantageous to the welfare of the body," he says; "and there is, physiologically speaking, equally good ground for considering that the storage of unorganized proteid in amounts beyond all possible requirements of the body may be equally undesirable. Because less tangible to the eye, the accumulation of unnecessary proteid is not so easily recognizable, but this fact does not diminish the possible danger which such accumulation may constitute."[1]

Formerly it was thought that the combustion of proteid matter in the blood was the main source of energy for muscle work, but it is now known that while proteid matter is capable of yielding a certain amount of heat and energy in oxidation, it is inferior for this purpose to the fats and carbohydrates, and also that proteid, in burning, yields certain de-

[1] Chittenden, "Nutrition of Man," p. 131.

leterious products which may be a serious evil to the body and which throw upon the liver and kidneys an amount of unnecessary labour that is likely to weaken and throw them open to the attacks of disease.

"Therefore," says Professor Chittenden, "in the nourishment of the body for vigorous muscular work, there is reason in a diet which shall provide an abundance of carbohydrate and fat; proteid being added thereto only in amounts sufficient to meet the ordinary requirements of the body for nitrogen and to furnish, it may be, proper pabulum for the development of fresh muscle fibres, where, as in training, effort is being made to strengthen the muscle tissue and so enable it to do more work. Increase in proteid food may help to make new tissue, but the source of the energy of muscle work is to be found mainly in the

breaking down of the non-nitrogenous materials, carbohydrate and fat."[1]

Furthermore, Professor Chittenden also points out that proteid decomposition products are a constant menace to the well-being of the body. "Proteid foods," he says, "when oxidized, yield a row of crystalline nitrogenous products which ultimately pass out of the body through the kidneys. Prior to their excretion, however, these products—frequently spoken of as toxins—float about through the body and may exercise more or less of a deleterious influence upon the system, or, being temporarily deposited, may exert some specific or local influence that calls for their speedy removal. Hence, the importance of restricting the production of these bodies to the minimal amount, owing to their possible physio-

[1] Chittenden, "Physiological Economy in Nutrition," pp. 16–17.

logical effect and the part they are liable to play in the causation of many diseased conditions. Further, the elimination of excessive amounts of these crystalline nitrogenous bodies through the kidneys places upon these organs an unnecessary burden which is liable to endanger their integrity and possibly result in serious injury, to say nothing of an early impairment of function."[1]

"Gastro-intestinal disturbance, indigestion, intestinal toxæmia, liver troubles, bilious attacks, gout, rheumatism, to say nothing of many other ailments, some more and some less serious, are associated with the habitual overeating of proteid food."[2]

"The minimal proteid requirement of the healthy man under ordinary condi-

[1] Chittenden, "Nutrition of Man," p. 269.

[2] Chittenden, "Physiological Economy in Nutrition," p. 475.

tions of life is far below the generally accepted dietary standards, and far below the amount called for by the acquired taste of the generality of mankind," is Professor Chittenden's conclusion. "Expressed in different language, the amount of proteid or albuminous food needed daily for the actual physiological wants of the body is not more than one-half that ordinarily consumed by the average man. Body-weight (when once adjusted to the new level), health, strength, mental and physical vigour, and endurance can be maintained with at least one-half of the proteid food ordinarily consumed; a kind of physiological economy which, if once entered upon intelligently, entails no hardship, but brings with it an actual betterment of the physical condition of the body. It holds out the promise of greater physical strength, increasing endurance, greater freedom from fatigue,

and a condition of well-being that is full of suggestion for the betterment of health."[1]

For a man of average weight, Professor Chittenden declares that 60 grams or two ounces of proteid food a day are ample to meet all the needs of the body. A larger man requires somewhat more, since it is obvious that he has more proteid tissue to nourish.

"The long-continued experiments on many individuals, representing different degrees of activity," says Professor Chittenden, "all agree in indicating that equilibrium can be maintained indefinitely on these smaller quantities of food, and that health and strength can be equally well preserved, to say nothing of possible improvement. The lifelong experience of individuals and of communities affords sufficient corroborative evi-

[1] Chittenden, "Nutrition of Man," pp. 227–8.

dence that there is perfect safety in a closer adherence to physiological needs in the nutrition of the body, and that these needs, so far as proteid food is concerned, are in harmony with the theory of an endogenous metabolism, or true tissue metabolism, in which the necessary proteid exchange is exceedingly limited in quantity. There are many suggestions of improvement in bodily health, of greater efficiency in working power, and of greater freedom from disease, in a system of dietetics which aims to meet the physiological needs of the body without undue waste of energy and unnecessary drain upon the functions of digestion, absorption, excretion, and metabolism in general; a system which recognizes that the smooth running of man's bodily machinery calls for the exercise of reason and intelligence, and is not to be entrusted solely to the

dictates of blind instinct or to the leadings of a capricious appetite."[1]

These facts — particularly the ones which represent the most recent discoveries in the physiology of nutrition — would seem to constitute a sound scientific basis for the theories of the layman, Mr. Horace Fletcher. If it is true—and there seems to be no longer any dispute about it—that the starches and sugars are capable of being almost wholly digested by the action of the saliva alone, it is clear that the degree in which these foods can be utilized by the body must be in proportion to the mouth-treatment they receive.

In his insistence upon the importance of appetite and taste, Mr. Fletcher seems only to have forestalled the scientists. Before Professor Pavlov was awarded the Nobel Prize for discovering that pri-

[1] Fletcher, "New Glutton or Epicure," pp. 144–5.

marily it was the appetite for and the taste of food that caused the secretion of gastric juice in the stomach, Mr. Fletcher was being laughed at for his appeals to his fellow-men not to eat until they were hungry and not to swallow their food until they had extracted every vestige of taste from it. To-day all up-to-date physicians and physiologists recognize the fact that the thoroughness with which normal digestion is effected depends primarily upon the keenness of the desire for food, and the zest with which it is eaten. While the fact that sick people without appetites and lunatics with insane fears of food can be kept alive by forced feeding indicates that the mere presence of food in the stomach will cause enough gastric secretion to ensure some sort of digestion, it does not affect the argument that the secretion necessary to perfect digestion is secured only through

the operation of appetite and taste. Dogs whose stomachs have been removed have been known to live and even flourish, but no sane person would conclude from this fact that he could get along just as well without a stomach as with one.

When Mr. Fletcher launched his dictum, "Never eat when you are mad or sad; only when you are glad," he was unknowingly applying the scientific truth, proved by Dr. Cannon through the Röntgen Ray experiments previously alluded to, that pleasure accelerates and distress inhibits all the digestive secretions.

The observations and experiments upon Mr. Fletcher have given convincing demonstration that his method of eating produces naturally the aseptic condition in the lower intestines which the physicians and physiologists have been trying to effect by artificial means. His excretions, when analysed, were found

to be made up of an inoffensive deposit of dry cellulose and other unabsorbable matter, that was absolutely free from the slightest trace of bacterial decomposition, and that was collected in the lower intestines so slowly and in such extremely small quantities as to require release only once in every eight or ten days.

"One of the most noticeable and significant results of economic nutrition gained through careful attention to the mouth-treatment of food, or buccal-digestion, is," says Mr. Fletcher, "not only the small quantity of waste obtained, but its inoffensiveness. Under best test-conditions the ashes of economic digestion have been reduced to one-tenth of the average given as normal in the latest text-books on physiology. The economic digestion-ash forms in pillular shape, and when released these are massed together,

having become so bunched by considerable retention in the rectum. There is no stench, no evidence of putrid bacterial decomposition, only the odour of warmth, like warm earth. Test examples of excreta, kept for more than five years, remain inoffensive, dry up, gradually disintegrate and are lost."[1]

Last, and by no means least, as has been pointed out before, Mr. Fletcher's practice seems to have furnished a natural and automatic method for reducing the amounts of food demanded by the appetite—particularly proteid food—to amounts to which Professor Chittenden has shown to be in accord with true physiological needs.

[1] Fletcher, "New Glutton or Epicure," pp. 176–7.

CHAPTER III

TOPICS: The principles of Mr. Fletcher's theories. Appetite, true and false. Taste, the guardian of the digestive tract. Nature's Food Filter. The Art of Mastication. Inutility of Gladstone's rule. Inhibitive effect of excess of attention. Influence of the mental and emotional state. Objections to the system considered. Results. Testimony of the rejuvenated.

ALTHOUGH Professor Chittenden has shown that restriction of diet through the use of the reason alone is productive of great good to the human organism, the author's belief is that the easiest, surest, and simplest method of reaping all the benefits of the new discoveries in dietetics is through the practice of Fletcherism. The average man cannot work out a physiologic ration for himself, nor is it wholly desirable that he should attempt to do so. Although there is not as yet sufficient proof to satisfy

physiologists, from a scientific point of view, it does seem that a healthy, normal appetite is practically the surest guide to a properly balanced diet. Perhaps the most valuable feature of Mr. Fletcher's theories is the fact that it restores even diseased appetites to a healthy and normal state. The experiments upon Mr. Fletcher and Dr. Van Someren, and the testimony of many persons who have adopted the new plan of diet, indicate that the practice of prolonged mastication automatically reduces the food demanded by the appetite to the quantities and proportions which Professor Chittenden has shown to be in harmony with the real needs of the body.

The first rule for the practice of Mr. Fletcher's theories is, therefore, to wait for an appetite before eating, and to make sure that it is a real and not a false one.

There is a vast difference between these two things. Normal appetite is manifested in a specific physical sensation, described literally by the old-fashioned phrase "a watering of the mouth." It asserts itself only when the body is in actual need of fuel, or material for growth or repairs. False appetite, on the other hand, is expressed in a general feeling of restlessness—often quite as much of the mind as of the body; or in a sense of actual discomfort, described variously as emptiness, faintness, dizziness, allgoneness, etc.[1]

[1] "Study Normal Appetite and heed its invitation. It prescribes wisely. Its mark of distinction, to differentiate it from False Appetite, is 'watering of the mouth' *for some particular thing.*"—Fletcher, "The New Glutton or Epicure," p. 107.

False Appetite is a general discontent of the body, indefinite of description. It is often expressed by "allgoneness," or stomach craving, and calls for *something*, ANYTHING! to smother the discomfort of present or recent indigestion. It is like the thirst which follows a debauch.

"Ignore false appetite, and wait for a return of

None of these sensations is an indication of a real need of the body for food. The restless craving is due merely to habit—the fact that the body has been accustomed to receiving certain quantities of food at certain hours—and if food is not available,

normal appetite. It will come as soon as body repairs have been effected by natural agencies and more material is required. No one was ever injured by intelligently and calmly waiting for an appetite. No one ever starved to death for lack of appetite. Most human ills come from forcing appetite, anticipating appetite, abuse of appetite in some form.

"In its normal state, appetite is a perfect indicator of the bodily need of nutriment and moisture, both as to quality and as to the chemical elements required at the moment."—Fletcher, "The A. B.—Z. of Our Own Nutrition," p. 6.

"Appetite craves the kind of nourishment the body needs, invites to eating, gives enjoyment during the whole time needed for the fluids of the mouth and the stomach to do their part of the digestive process. . . . If consulted and obeyed, Taste and Appetite prevent indigestible matter from entering the system to burden and clog the lower intestines, form deposits in bone, cartilage, and kidneys, inflame the tissues, and otherwise create conditions favourable to the propagation of the microbes of disease."—Fletcher, "New Glutton or Epicure," pp. 152–3.

it soon passes away and does not reappear again until the next meal-time; while all positively disagreeable sensations arise from unhealthy conditions somewhere in the digestive tract. Persons who complain of a sense of emptiness in the stomach are suffering, not from lack of food, but from habitual overeating. Their stomachs have become distended to accommodate abnormal quantities; and, therefore, as soon as the food passes out into the intestines, the walls of the stomach collapse and give rise to the unpleasant sensations that are usually interpreted as a need for another meal.

The perfectly healthy person is indifferent to the thought of food except at such times as the organism sends in a sharp and unmistakable demand for fuel, for material for growth or repairs. As has been said, this demand should be expressed, not by the stomach, but by the

mouth, and should take the form of a keen desire for some particular article of food.

As far as possible a call of this kind should always be heeded, because it means, according to Mr. Fletcher, that the organism is in actual need of some element contained in the food desired. When the appetite is not absolutely diseased, the wisest as well as the pleasantest course is to eat what one likes and as much as one likes.

Here someone is sure to protest that whenever instinct alone is followed in the matter of food, it always has led and always will lead to gluttony. In support of their argument, they instance the case of the horse when he gets into the oat-bin or the cow when she gets into the meal-barrel; or, turning to history, they point out that the dietary habits of man himself, in all ages and among all races, have been far from temperate.

It seems as if there were a certain justification for this belief. It is undoubtedly true that gluttony has never been confined to the beasts. In Taine's "History of English Literature," for instance, we find the following vivid picture of the voraciousness of our own ancestors, the Saxons:

"Huge, white bodies, cool-blooded, with fierce blue eyes, reddish flaxen hair; ravenous stomachs, filled with meat and cheese, heated by strong drinks; of a cold temperament, slow to love, home-stayers, prone to brutal drunkenness. . . .

"They are more gluttonous, carving their hogs, filling themselves with flesh, swallowing down deep draughts of mead, ale, spiced wines, all the strong coarse drinks which they can procure, and so they are cheered and stimulated. . . .

"The ancient historians tell us that they had a great and coarse appetite.

. . . Henry of Huntingdon, in the twelfth century, lamenting the ancient hospitality, says that the Norman kings provided their courtiers with only one meal a day, while the Saxon kings provided four. To shout, to drink, to caper about, to feel their veins heated and swollen with wine, to hear and see around them the riot of the orgy, this was the first need of the barbarians. The heavy human brute gluts himself with sensations and with noises."[1]

But after all, is it the workings of natural appetite that we see pictured here? Is it not rather greed—man's passionate desire to get, reinforced by his love of pleasure—manifesting itself in a wild celebration of its emancipation from the checks originally imposed upon it by nature?

It must be remembered that food was

[1] H. A. Taine, "History of English Literature."

available to primitive man only in an extremely inaccessible form, or at the expense of hard work. The berries, nuts, roots, grains, and saps upon which he was forced to subsist for long periods of time were often scarce, and furthermore, the nutriment had to be extracted from them by means of a jaw treatment before which even a Fletcherite would quail. Animal food was even more difficult to obtain because of the inadequacy of the primitive weapons of the chase. The primitive man was restrained perforce from eating before the physical sensation of appetite had asserted itself, because, in the case of vegetable food, he never could get enough, and in the case of animal food, a feast was won only at the expense of exertion that in itself was sufficient to create an appetite. The perpetual scarcity of food implanted in the race those powerful impulses to eat as much as

possible that we see surviving to-day in civilized man. When man's increasing power over nature gave him access to increasingly large quantities of food, it was inevitable that this old instinct, born of the time when he could never get enough, and nourished by his desire for pleasure, should assert itself and lead him into excess.

However, the unbridled gratification of this impulse brought its own punishment. Centuries of excess in eating imposed upon mankind, not only disease and premature old age, but the curse of satiety. When man fell into the practice of eating for pleasure alone, he found that his pleasure was gone. Now, therefore, he is beginning to learn that he can win back the old primitive delight in eating only by waiting for the old physical need for food. For the natural checks imposed upon the savage, he is beginning

to substitute the checks of reason and intelligence. He has realized at last that he must ignore the promptings of greed and direct his attention solely to satisfying the physical sensations of true appetite. In doing this he has developed a new instinct, which, for want of a better name, may be called the instinct for physiological economy, since it manifests itself in a keen desire to save the body from the labour of taking care of unnecessary quantities of food.

In acquiring this instinct he has been helped greatly by the sense of taste. As natural appetite is man's surest guide as to when to eat, taste is his guide as to what and how much to eat. Taste, asserts Mr. Fletcher, is the infallible sign by which we may know that the body needs and can use the food we are sending into it. When food has no taste the

body does not need it and cannot use it. When food tastes bad, it is bad.

"There is now no doubt," says Mr. Fletcher, "but that taste is evidence of a chemical process going on that should not be interrupted or transferred to the interior of the body.

"Taste is evidence of nutrition.

"Whatever does not taste, such as glass or stone, is not nutritious.

"Taste is excited by the dissolving of food in the mouth, and while it lasts a necessary process of preparation for digestion is going on.

"The juices of the mouth have the power to transform any food that excites taste into a substance suitable for the body.

"Nothing that is tasteless, except water, should be taken into the stomach.

"If we swallow only the food which excites the appetite and is pleasing to

the sense of taste, and swallow it only after the taste has been extracted from it, removing from the mouth the tasteless residue, complete and easy digestion will be assured and perfect health maintained."[1]

"Taste," he adds, "is the faithful servant of appetite; the sentinel of the stomach, of the intestines, of the tissues and of the brain, whose guidance and warning, if heeded, will give heretofore unknown enjoyment of eating, and at the same time perfect health and a maximum of strength."[2]

"How many men," asks Mr. Fletcher, "can honestly say that they taste their food? As a matter of fact, they taste the sauce and bolt their meat; they taste the butter and swallow their bread whole; they taste the sugar and their pie goes

[1] Fletcher, "New Glutton or Epicure," pp. 109–10.
[2] *Ibid.*, p. 152.

down at a gulp; as for liquids, it may be safely said that the average man never achieves so much as a speaking acquaintance with his drinks—his coffee, his tea, his high-balls, his cocktails, his wine and his beer. If he did—and this is no theory, but a well-authenticated fact—he would have no such thing as a tea or coffee habit, and he not only never would be, but never could be a drunkard. In order to give the monitor of the mouth a chance to do its work, the solid foods must be divided into small particles by the teeth, and both solids and liquids must pass slowly and in small quantities over the taste-buds on the tongue and both must be thoroughly saturated with saliva. This means mastication—not the 'thorough chewing' of parental command and medical advice—but mastication to a point of such completeness that the food is literally tasted out of existence and

taken into the stomach by an involuntary swallowing impulse."[1]

According to Mr. Fletcher's theories, if a man follows this practice—not with rigid conscientiousness, but with zest and enjoyment—he need never go to a doctor to find out what is "good for him" to eat. Anything that tastes good is good. If he pays attention to the physical sensations in his mouth and retains every morsel of food as long as it continues to minister to these sensations, he can never eat anything that is bad for him, never overeat, and, if he treats liquids in the same way, he can never overdrink.

In fact, Mr. Fletcher contends that in time he will develop in his throat a contrivance that will throw back into his mouth anything he attempts to swallow

[1] Frances Maule Björkman, *The Scrap Book*. New York, November, 1907.

that has not first been made perfectly acceptable to the body by thorough mastication. Mr. Fletcher has given to this contrivance the picturesque and suggestive name of "Nature's Food Filter." Dr. Van Someren describes its working as follows:

"Food, as it is masticated, slowly passes to the back of the mouth, and collects in the glosso-epiglottidean folds, where it remains in contact with the mucous membrane containing the sensory end-organs of taste. If it be properly reduced by the saliva it is allowed to pass the fauces—a truly involuntary act of deglutition occurring. Let the food, however, be too rapidly passed back to these folds, i.e. before complete reduction takes place, and the reflex muscular movement above referred to occurs. . . . The late contents of the glosso-epiglottidean folds are returned to the front of

the mouth for further reduction by the saliva preparatory to deglutition."[1]

"The Food Filter, when rightly performing its protective function, is impervious to anything except pure water at the right temperature for admission to the stomach and to nutriment which has been properly dissolved and chemically converted by salivation (mixture with saliva) into a substance suitable for further digestion."[2]

The tasteless residue that is rejected by the Food Filter is invariably composed of matter that is unprofitable if not actually injurious to the body, and should, therefore, be rejected. To the objection that it is impossible to remove this residue from the mouth, Mr. Fletcher replies, "Without violating the canons of good

[1] Fletcher, "A. B.—Z. of Our Own Nutrition," pp. 32–33.

[2] Fletcher, "New Glutton or Epicure," pp. 110–11.

form, do you not remove cherry pits, grape skins, the shell of lobster, bone, etc., when you encounter them? Then why not remove the fibrous matter found in tough, lean meat, the woody fibre of vegetables, or anything rejected by instinctive desire to discard it after taste has been exhausted, and which is a protection provided by beneficent Nature? . . . If fibre is found in the food, it can be put upon the fork in the same manner that a cherry pit is usually handled and transferred to the plate without observation."

"There is nothing more pronounced than . . . the impulsive desire to spit out of the mouth anything that seems unprofitable to the senses.

"Muscles have been provided for this purpose that are more facile than those of an elephant's proboscis. . . . If you acquire the habit of practising only invol-

untary swallowing in eating you will find that these muscles are very discriminating, and will instinctively assist in the rejection of unprofitable matter.

"Their sense of touch will soon discriminate against unprofitable food even when the sense of taste is fooled by some alluring sauce or condiment."[1]

"When food is filtered into the body after having become liquefied and made alkaline, or at least neutral, by saliva," continues Mr. Fletcher, "the appetite is given a chance to measure the need of the body and to discriminate against excess. As soon as the point of complete saturation of any one deficiency is reached, the appetite is cut off, as short as possible to imagine, with no indication of stomach fullness.

"The appetite satisfied by the infiltering process is a sweetly appeased appetite,

[1] Fletcher, "New Glutton or Epicure," pp. 117–23.

calm, rested, contented, normal. There is no danger from the flooding of intemperance, for there is not even toleration of excess either of more food, or more drink, and this contented appetite will remain in the condition of contentment until another need has really been earned by evaporation or destructive katabolism."[1]

"The normal sensitiveness of taste can be recovered," he declares, "if already lost, in the course of a week, or two weeks at most, by means of the stimulating and regenerating influence of natural body repair, if the method of taste and appetite cultivation recommended in this book is followed."[2]

As Professor Irving Fisher has said, "It is fortunate for the ordinary man that the taste instinct can be so easily

[1] Fletcher, "A. B.—Z. of Our Own Nutrition," p. 95.

[2] Fletcher, "New Glutton or Epicure," p. 153.

revived, for it would be out of his power to prescribe for himself each day the exact quantity of food necessary for that day's work—the proper proportions of proteid, fat, starch and sugar, and the amounts needed of the fifteen odd mineral salts, to say nothing of acids and enzymes, for each of which only one definite amount is ideally correct.

"The loss of the delicate food instinct in the ordinary man has been aggravated not only by the habit of food bolting, but the habit of eating what is set before us by others, instead of choosing our food for ourselves. In the experiment at Yale none of the men were served anything until they had looked over the menu and made their own choice. While this procedure is not always practicable at home or in boarding houses, it is nevertheless within the power of the ordinary individual to use his power of choice more

than he does at present. If he will do so, he will usually be rewarded in a few months by reaching a condition of physical and mental efficiency of which he had scarcely dared to dream. The instinct to eat was given us for the purpose of enabling us to adapt our daily food to our varying daily needs. The realization that we have let this valuable instinct atrophy by disuse is the needed incentive to restore it to activity."[1]

In adopting the practice of Mr. Fletcher's system, however, it is well not to be too conscientious in regard to the mere mechanical act of chewing. "Excess of attention," says Dr. C. W. Saleeby, "interferes as markedly as carelessness with the performance of many subconscious or semi-automatic acts."[2]

[1] Prof. Irving Fisher, *The Independent.* New York, August, 1907.

[2] Dr. C. W. Saleeby, "Worry, the Disease of the Age," p. 34.

There is no doubt that too much thought directed upon the act of eating has a tendency to inhibit the digestive secretions. It is a perfectly healthy instinct that prompts the average man to think as little about his food as possible, and to demand only that it taste good.

"He who counts his chews or makes hard work of mastication, by attending only to the mechanical act of chewing," says Prof. Irving Fisher, "will receive more harm than good from the practice. The food should be chewed and relished with no thought of swallowing. There should be no more effort to prevent than to force swallowing. It will be found that if we attend only to the agreeable task of extracting the flavours from our food, Nature will take care of the swallowing, which will become, like breathing, involuntary. It will also be found that taste will grow more discriminating and

can be depended upon to guide us, both in respect to the kind of food, and also to the amount."[1]

"Above all things don't strain to be careful. Strain inhibits—paralyses—all of the glandular functions and deranges the nervous nicety of adjustment. Just eat slowly, deliberately, small morsels, and sip and taste small quantities of liquids and observe what happens."[2]

"Numbers of mastications . . . are no guide to be relied upon.

"Gladstone's dictum, 'Chew each morsel of food at least thirty-two times,' was of little value except as a general suggestion. Some morsels of food will not resist thirty-two mastications, while others will defy seven hundred."[3]

[1] Prof. Irving Fisher, *The Independent*. New York, August, 1907.

[2] Fletcher, "New Glutton or Epicure," p. 126.

[3] *Ibid.*, p. 127.

Therefore, needless to say, there should be no attempt to "count the chews." Even Gladstone did not carry out in his own case his advice to his children to chew each mouthful thirty-two times. Dr. Hubert Higgins says[1] that an interested observer in the strangers' gallery at a public dinner in Cambridge took pains to count the jaw movements of the great statesman to each mouthful of food, and found that the number was usually as many as sixty or seventy. Even if counting the chews did not have this tendency to check the flow of the digestive juices, the practice could be of no value as a guide to the amount of chewing required because each food demands a mouth-treatment all its own. Furthermore, because of the difference in the supply and the alkalinity of the saliva in individuals, no two persons

[1] Dr. Hubert Higgins, "Humaniculture," p. 101.

can be sure of disposing of a morsel in the same number of mastications. "One person," says Mr. Fletcher, "may dispose of a morsel of bread in thirty mastications so that the last vestige of it has disappeared by involuntary process into the stomach. Another person, of similar general health appearance, selecting as nearly as possible an equal morsel of bread, may require fifty acts of mastication before the morsel has disappeared. . . . The dissimilarity lies in the difference of the copiousness and strength of the secretions at the time of trial."[1]

It should be noted in this connection, however, that, just as the strength of the arm is increased by exercise, so the vigorous use of the mechanism of mastication increases its efficiency. The secretion of saliva is not only increased, but is rendered more alkaline. Despite the popular

[1] Fletcher, "New Glutton or Epicure," pp. 125–6.

idea, Mr. Fletcher himself is a fast eater. Having made a vigorous and persistent use of his masticatory apparatus for ten years, he is now able to keep pace with the average eater, and yet fulfil all the conditions of complete mastication. The actual time that he spent over his two daily meals during the Yale tests was from twelve to fifteen minutes each. From this it will readily be seen that there are no grounds for the common belief that it is necessary for a follower of Mr. Fletcher to spend an unusual length of time over his meals.

And here it should be emphasized that all that has been said in regard to the importance of mastication and insalivation applies to fluid as well as to solid food. As Mr. Fletcher points out, liquid food is a form of sustenance invented by civilization that Mother Nature did not count with when she planned the human body.

The only fluid food provided by Nature is milk, the natural method of procuring which is by sucking, a process exactly analogous to chewing. The wisdom of this arrangement can well be understood when it is remembered that milk, when taken into the stomach, is transformed into a thick curd, and must undergo digestion as a solid. Naturally, the stomach can handle a number of these small curds much more easily than it can one large one.

In order that soups and beverages may be submitted to the digestive action of saliva, it is necessary that they should be given careful mouth treatment before being swallowed into the stomach. "Food (drunk without mixing it with saliva) is a sort of nutritive self-abuse," says Mr. Fletcher, "and the only way to avoid the ill effect is to give it the same chance to encounter saliva that the constituent

ingredients would have had in a more solid state. . . . Anything that has taste, even soup, wine, spirits or whatsoever is tried, will resist numerous mastications before being absorbed by Nature's Food Filter. Above all things, milk, wines, etc., should be sipped and tasted to the limit of compulsory swallowing." [1]

Mr. Fletcher declares (and the testimony of all the people who have tested his theory upholds him), that when tea, coffee, and alcoholic liquors are thoroughly insalivated before being swallowed, the appetite will refuse to receive them except in extremely small quantities, if it does not refuse to receive them at all.

"When the body will tolerate spirits tasted into it—not poured into it—at all," says Mr. Fletcher, "which is not often when the nutrition is normal (only

[1] Fletcher, "New Glutton or Epicure," p. 112.

in damp or cold weather, as a general thing, and then, in the case of the writer, only at rare intervals, say two or three times a year), the spirit will mix quickly with the saliva and become neutralized sufficiently to excite the swallowing impulse. Continue sipping the spirit for a time and you will note that there comes a point where the saliva and the spirit do not mix, do not neutralize; the mouth becomes unduly full of liquid without any relaxation or invitation of the swallowing impulse, and the really instinctive inclination will be to spit it out. It is a clear indication that the body toleration has been fully taxed; there is no longer any bodily need for alcohol—in fact, there is no longer natural toleration—and the secretion sent down into the mouth is evidently mucous for a washing-out process, and is not alkaline saliva for assisting in a utilization function.

"It will be difficult to convince the advocate of total abstinence that any whiskey can be taken in a seemingly harmless form, but it is true that thorough insalivation of beer, wine or spirits, until disappearance by involuntary swallowing, robs them of their power to intoxicate, partly because appetite will tolerate but little.

"As a matter of fact, whiskey taken in this analytical way is a sure means of breaking up desire for it, and is an excellent protection in drinking as well as in eating. Many of our test subjects have been steady and some heavy drinkers, but persistent attention to Buccal - Thoroughness has cured all of them of any desire for alcohol, and in time surely leads to complete intolerance of it." [1]

[1] Fletcher, "A. B.—Z. of Our Own Nutrition," pp. 93–4; "New Glutton or Epicure," pp. 128-9.

There has been a good deal of controversy among those who follow Mr. Fletcher's practice as to whether conversation at meals is likely to interfere with the process of mastication. Mr. Fletcher himself declares that it does not. He is a generous entertainer and is extremely fond of having his friends with him at table.

"It is true," says Mr. Fletcher, "that one cannot converse freely with large morsels of food in the mouth. It is also true that it is nothing less than a gluttonous custom to greedily take a big mouthful of food, and, if accosted with a question, to bolt it in order to answer.

"It will be found easy to carry on conversation without disagreeable interruptions and yet follow Nature's demands in properly masticating food by taking small morsels into the mouth. It will be found also to add to the real pleasure of eating,

and eventually will become a habit by choice."[1]

On the other side, Dr. Daniel S. Sager says: "Despite the commonly accepted idea, conversation is apt to interfere seriously with the proper mastication of food and to diminish the pleasure of eating, which should be all-absorbing for the time. The Hindu sages of antiquity considered eating a kind of sacrament to be engaged in abstemiously and silently. The Pythagorean sect ate in profound silence. Shakers never speak at the table, except in receiving or in passing food. At all events, whether the meal is eaten with merry conversation or with Quaker-like silence, the essential thing is complete mastication of the food. Throughout, one should be intent upon the pleasure of eating and the gratification of the sense of taste. . . . If one

[1] Fletcher, "New Glutton or Epicure," p. 119.

would enjoy food to its fullest possible extent, it is accomplished to perfection by a concentration of the mind upon the tip and sides of the tongue, and by thinking and feeling how extraordinarily good the food tastes."[1]

To most people "mirth and merry company" at table are too valuable as aids to digestion to be lightly banished; and if, as Mr. Fletcher says, the food is taken in small mouthfuls, there seems to be no reason why they should not indulge their desires in this respect as much as they wish.

The adoption of Mr. Fletcher's system results immediately and invariably in certain marked changes in the dietary habits. If a man conscientiously "waits for an appetite," he will find that it registers a demand for food not more than twice a day. As an ordinarily good

[1] Sager, "Art of Living in Good Health," pp. 24–5.

digestive apparatus cannot dispose of an average meal in less than six hours, and as the digestive apparatus should be permitted a certain amount of rest, it would seem that there was every reason why the prompting of the appetite should be followed. Crato, one of the physicians of antiquity, said, "Eat but twice a day and put seven hours betwixt dinner and supper"; and since his time the wisest physicians of all periods have been pleading with their patients not to send food into their stomachs until the previous meal has been disposed of.

In most cases, the meal most easily eliminated is breakfast. In the early morning when the body has been lying inert for several hours, with the utilization of heat and energy and the breaking down of tissue reduced to a minimum, there can be no genuine need for food. The common declaration of the average

man that he has to have a square meal as soon as he gets up "to work on" is not based on physiological principles. It is obvious that no man works on the food that is in his stomach. Food in the stomach, or in any other part of the digestive tract, takes energy rather than gives it. Food becomes available only when it has been digested and assimilated.

Therefore, there is no doubt that the heavy American breakfast is a most unwholesome institution. If any food is to be taken at all in the morning it should be limited to the Continental breakfast of rolls and coffee, or something equally light. Mr. Fletcher, himself, has for years made it his custom not to eat at all until he has finished his day's work. Many instances might be given of great men who have followed this plan, because personal experiment

had shown that the brain is clearest when the stomach is empty.

On no account, however, should any marked reduction of food be made suddenly. The best plan is not to change the dietary at the start at all, but merely to begin the practice of mastication — giving attention to the taste of the food and not to the jaw movements—and let appetite be the guide.

It will be found much easier to resist the old impulse to hurry down masses of untasted food if only small portions are placed on the table and served on the plate. With only a small amount of food before him, a man will make the most of it, just as a child will make a small piece of candy last as long as a big piece if he knows that the small piece is all that he is going to get: whereas, if the man is given a large

portion, his tendency is to bolt it without submitting it to the discriminations of taste, just as a child would bolt candy as long as he knows there is more coming.

A very few weeks of complete mastication will lead, however, to an automatic reduction of the diet to true physiologic needs, and also to a great simplification of tastes. Under the old way of eating the tendency is towards number and variety of complex, highly flavoured foods; the practice of analytical tasting leads to a preference for one or two dishes of simple and delicate flavour uncomplicated by sauces and condiments. The experience of almost everyone who has adopted the new plan is that the taste for stimulating foods of every character gradually disappears. No one need try to give up meat, condiments, tea, coffee, alcohol and

tobacco, because if he continues to masticate conscientiously for several months he will have no desire to indulge in them to any harmful extent.

The man who has developed the delicate instincts of taste and appetite that Mr. Fletcher has shown to be latent in every human being can restrict his diet to exact physiological requirements without imposing upon himself anything like self-denial. He no longer feels any temptation to indulge in the pernicious practice of eating to kill time, because he not only has no desire to eat except when there is a physiological demand for food, but he actually cannot make himself eat. When, however, in answer to the call of genuine appetite, he does sit down to his meal, he enjoys his food as he never did before.

The adoption of the new system is extremely likely to be followed by a

sudden and a very considerable loss of weight. This should not, however, be cause for alarm to anyone. The latest discoveries of science have proved conclusively that we know nothing whatever in regard to the relation of a man's weight to the state of his health. The tables prepared by life insurance companies purporting to give the number of pounds that a man should weigh in proportion to his height and age are mere guesses based on their observation of the fact that healthy men, of given heights and ages, tend to tip the scales at the same point. This proves that these men have these weights, not that they should have them. Scientific authorities do not presume to say how many pounds a man needs to carry to be in perfect health, because they do not know. Experience tends to prove, however, that the old idea that fat people are the

healthiest is a fallacy, and that, as a matter of fact, it is the thin, wiry people who are likely to live longest and enjoy the best health. The experience of most of us is, probably, that the best health we have ever enjoyed was in the "spindling" period of our youth, when our extreme leanness often made us a butt for the humorous remarks of our friends.

Professor Chittenden says that obesity is a condition which is distinctly undesirable and may prove decidedly injurious. "Undue accumulation of fat," he says, "is not only a mechanical obstacle to the proper activity of the body as a whole, but it interferes with the freedom of movement of such muscular organs as the heart and stomach, thereby interposing obstacles to the normal action of these structures. Further, whenever undue fat formation is going on in the body, there is the ever-present danger

that the lifeless fat may replace the living protoplasm of the tissue cells and so give rise to a condition known as 'fatty degeneration.'"[1]

"Let any actuary of life insurance," says Dr. Edward Curtis, "be asked his experience with heavy-weight risks, where the waist measures more than the chest, and the long-drawn face of the business man, at memory of lost dollars, will make answer without need of words. Then let it be noted the physique of the blessed ones that attain to green old age, and, in nine cases out of ten, spry old boys—no disparagement, but all honour in the phrase—will be found to be modelled after the type of octogenarian Bryant or nonagenarian Bancroft—the white-faced, wiry and spare, as contrasted with the red-faced, the pursy, and the stout. It is true, as has already been

[1] Chittenden, "Nutrition of Man," p. 270.

mentioned, that in old age much of an adventitious obesity is absorbed and disappears, but the Bryant-Bancroft type is that of a subject who never has been fat at all. And just such is pre-eminently the type that rides easily past the four-score mark, reins well in hand, and good for many another lap in the race of life."[1]

"Thorough repair of an impaired body may not be effected immediately," says Mr. Fletcher, "although wonderful results — almost miraculous — have been obtained in three months; but a week's faithful and attentive study of the possibilities of Epicureanism, with right alimentation as its basic requirement, in adding to the comfort and enjoyment of life, will result in right eating being made physiologically and religiously habitual, and will give a backbone of

[1] Dr. Edward Curtis, "Nature and Health," p. 70.

Epicurean character that will not easily succumb to gluttonous impetuosity."[1]

"The result, in all cases of my observation, has been an immediate response of naturally increased energy; approach of weight toward the normal, whether the subject was overweight or underweight; a great falling off of the waste to be discharged by the avenue of the lower intestines and also through the kidneys; relief of bleeding hemorrhoids and catarrh; emancipation from headaches; clearing of the tongue of yellow deposit; and return of the energy for work which all men and women should have, and which finds expression in healthy children in the form of great energy for play."[2]

The following statements of the experience of Dr. Hubert Higgins and Dr.

[1] Fletcher, "New Glutton or Epicure," p. 131.
[2] *Ibid.*, pp. 174–5.

Ernest Van Someren are of particular value from the fact that, as physicians, they have been able to make unusually exact and scientific observations upon themselves and therefore to arrive at particularly valuable conclusions.

"The best period of health that I can remember in my life," writes Dr. Higgins, "was that between seventeen and twenty-one, during the time I was preparing for the medical profession. I had a small breakfast at about 7.30 a.m. and then went up to London to St. George's Hospital, which was about fourteen miles from my home. My parents gave me 2s. 6d. for my midday meal, but I fortunately economized and only spent 6d. to 10d. of it on food. After finishing my work I usually arrived home at 5.30 and had a 'meat tea'; this allowed me to devote six hours to reading. During the whole of this period I was in

excellent mental and physical condition. I was made house surgeon at twenty-one, obtained my degree in under four years, besides obtaining several valuable prizes.

"After this I lived in the hospital, where three meat meals were provided. These I conscientiously ate 'to keep up my strength' during the performance of my exhausting duties. I consider that this period was the commencement of my degeneration. I put on twenty-four pounds in weight, and lost much of my mental energy.

"My strong hereditary tendency to gout, with the excessive meat eating, the hurried eating, during some three and one-half years at St. George's Hospital, London, and at Addenbrooke's Hospital, Cambridge, resulted in constant suffering from headache, lumbago, rheumatic pains, and all those distressing symptoms known under the generic name of 'goutiness.'

After seven or eight years I weighed two hundred and twenty-four pounds and complained of increasing symptoms of gout. I then became a patient of Dr. H—— of London, whose system requires one to abstain from meat, fish, poultry, beans, tea, coffee, in other words, from foods containing uric acid or its equivalent. For about five years, till the end of 1901, when I first met you, I fluctuated considerably in health, on the whole, I am bound to say, in a steadily downward direction, till I was overloaded with the excessive weight of two hundred and eighty-two pounds.

"I commenced, under your advice, masticating my food thoroughly at the end of December, 1901. After practising this method till the present September, 1903, I have lost one hundred and four pounds in weight and consider that I have gained very considerably in mental and

physical fitness. I prefer to divide this period into two parts: (A) *The first eight months.* During this time I followed my appetite, but with a strong mental bias in favour of keeping up as nearly as possible to the daily 'physiological ration' of nitrogenous food. I lost, notwithstanding, some sixty-four pounds in weight in spite of having an inordinate appetite for butter, and generally taking two pints of milk daily. During this period I undertook some very severe work in the Laboratory of Physiological Chemistry, with the object of trying to devise some method of measuring the extent of a person's departure from their optimum health. This led almost unconsciously to a stronger mental bias in favour of prescribing the amount of food one should eat, and to a certain number of experiments in feeding. Towards the end of

this period I got rather exhausted in consequence of my severe work and complained of occasional headaches. Following the suggestions of some friends, I added fifty grams of casein to my daily diet for two or three weeks. This was followed by a return of rheumatism and considerable sickness and inability to work. (B) *The subsequent six months.* I resolved to devote this period to a careful study of my desires for food—to take no notes—to make no experiments—in short, to allow my body to run itself, and to try to make my brain interpret the wants of the body. I had moved for the purpose of this experiment into a small house, with a boy and a woman, who came daily to clean the house. (I mention these details because practically one finds that a woman has usually such quick sympathy about matters concerning food that their agita-

tion and fears are enough in themselves to cause you to modify your diet.) I only kept bread, butter, and milk in the house, all other foods I was obliged to send for, and if I required a dish to be cooked, I first learned how to do it myself and then taught the boy. I had no fixed times for meals, and did not have a table laid, my food always being brought up on a tray; usually I did not interrupt the work I was doing. I deliberately adopted all these precautions because I had become aware by experience of the extraordinary influence suggestion, and other mind influences, such as habit, had in one's selection of food and the amount one ate. During the first two months in conscientiously eating what I wished, as much of it as I wanted and when my appetite demanded food, my desires were very irregular, ranging over meats and fish (occasionally), chocolate, sweets,

cream, cheese, butter, milk, bread, potatoes, oranges, bananas, sugar, etc., but during the final period my desires were much more simple and regular, confining themselves to bread, *Gruyère* cheese, butter, cream, bananas, and occasionally milk. During and subsequent to this period I have become convinced that provided you eat your food slowly and follow your appetite, without guidance from any other knowledge whatever, you get marked preference for simple foods with increasing health and happiness, the contentment that comes from the inestimably valuable possession of simple desires."[1]

"Three years ago, when I first met you," writes Dr. Van Someren to Mr. Fletcher, "though under thirty years of age, and myself a practising physician and surgeon, I was suffering from gout,

[1] Fletcher, "New Glutton or Epicure," pp. 226–35.

and had been under the régime of a London specialist for the treatment of that malady. Though vigorously adhering to the prescribed diet, I suffered from time to time. My symptoms were typical—paroxysmal pain in my right great toe and in the last joints of both little fingers, the right one being tumefied with the well-known 'node.' From time to time, generally once a month, I suffered from incapacitating headaches. Frequent colds, boils on the neck and face, chronic eczema of the toes, and frequent acid dyspepsia were other and painful signs that the life I was leading was not a healthy one. Yet I was accounted a healthy person by my friends, and was, withal, athletic. I fenced an hour daily, took calisthenic exercises every morning, forcing myself to do them, and I rowed when I obtained leisure to do so. In spite of this exer-

cise and an inherent love of fresh air, which kept all the windows of my house open throughout the year, I suffered as above. Worse still, I was losing interest in life and in my work. . . .

"In three months after the practice of these principles my symptoms had disappeared. Not only had my interest in my life and work returned, but my whole point of view had changed, and I found a pleasure in both living and working that was a constant surprise to me. For this, my dear Mr. Fletcher, I can never repay you. My only desire has been, and is, to try and do for others in my practice what you did for me.

"Now I have since that time had occasional colds, headaches, and gouty pains: but, whereas formerly I could not explain their causes, I can now invariably trace them to carelessness in the

buccal digestion of my food, and can soon shake them off."[1]

The following paragraph, taken from the "testimonial" of one of Mr. Fletcher's lay "patients," is valuable as corroborating Mr. Fletcher's claim that his system works automatically to reduce the food to true physiological needs.

"I have for some time been chewing *à la* Fletcher and find it of great advantage. It is getting to be automatic and is losing its irksomeness. Indeed it already seems natural and produces some results 'set down in the book.' For instance, I have no desire for meats and foods which do not lend themselves to the Fletcher method. This in itself is a great advantage.

"By the way, I have not eaten meat since the 20th of last October (nearly a year), and I find I have gained greatly.

[1] Fletcher, "New Glutton or Epicure," pp. 10–17.

I only desire two meals a day, except when the exigencies of travel make a light breakfast agreeable and desirable. By these means I have gained nerve force wonderfully and my muscular strength and endurance have increased so that I walk long distances and climb mountains easily. In fact, I do now with pleasure and avidity what I could formerly not do at all. They are the sort of things that are supposed to require a 'strong meat diet,' but which under such a diet were impossible to me. Mastication and thorough mouth-treatment seem to allow the appetite to prescribe what my body needs, and this is the essence and substance of your discovery. . . . There is no doubt in my mind but what there is a natural protection given us which has been lost by perversion."[1]

[1] Fletcher, "New Glutton or Epicure," pp. 213–15.

CHAPTER IV

Topics: True food requirements. Reduction of proteid. The question of meat-eating. Vegetable proteid. Amount of fuel-foods necessary. Specimen dietaries. Tables indicating proteid and fuel value of common foods. The question of stimulants and condiments. Physiological value of sugar. Inutility of foods as specifics. General principles. Conclusion.

EVEN when the regulation of the dietary has been handed over to an appetite made normal by the practice of slow eating and analytical tasting as recommended by Mr. Fletcher, there is a certain advantage in knowing what amounts and proportions of the various classes of foods are necessary—according to the new principles enunciated by Professor Chittenden—to make up a well-balanced ration.

It will be remembered that Professor Chittenden fixes the proteid requirement per day for a man of average—say 154 pounds—weight at 60 grams, about two ounces a day. A man with more muscular tissue to nourish will require more proteid, and a man with less muscular tissue will not need so much.[1] Taking into consideration the fact that 60 grams or 2 ounces of proteid are contained in half a pound of lean beef, seven-eighths of a pound of bacon, half a pound of fresh American cheese, two quarts of milk, nine eggs, one pound of baked beans, or two-thirds of a pound of almonds: it will readily be seen that the average man with his two or three meat meals a day —often reinforced with proteid in the form of cheese, milk, eggs, nuts, beans or peas—is getting a great deal more of this particular food element than

[1] Chittenden, "Nutrition of Man," pp. 271–2.

he needs or than he can use with advantage.

Since meat is the form in which proteid is consumed in the largest quantities, it is obvious that the quickest and surest way of reducing the excess of proteid is by cutting down the consumption of flesh food.[1] This should not, however, be

[1] Under flesh foods are included all meats and "stock" soups. It has been shown that although these extracts of meat contain a large amount of nitrogen, it is not in the form of proteid which can be utilized, but only of waste nitrogen which must be excreted. Apparently the sole virtue of such soups is that they supply the "peptogenic" stimulus.—Irving Fisher, Ph.D., "The Effect of Diet on Endurance." Publications of Yale University, pp. 44–5. New Haven, Conn.

It is well known that Liebig came to repudiate the idea that the extractives of meat were nutritious, and that investigation has shown them to be poisonous. Recently, Dr. F. B. Turck has found that dogs, mice, and rats fed on meat extractives exhibit symptoms of poisoning, and often die. The poisonous effect is aggravated by intestinal bacteria, which find in these extractives an excellent culture medium.—Irving Fisher, Ph.D., "Diet and Endurance at Brussels," *Science*, N.S., vol. xxvi, No. 669, pp. 561–3. October 25, 1907.

taken as a recommendation for a sudden and absolute elimination of meat from the diet. If there is one point which the discoverers of the new principles in dietetics insist upon more than another, it is that all changes in the dietary should be made gradually. In regard to the matter of meat reduction Professor Fisher says:

"The sudden and complete exclusion of meat is not always desirable, unless more skill and knowledge in food matters are employed than most persons possess. On the contrary, disaster has repeatedly overtaken many who have made this attempt. Pavlov has shown that meat is one of the most and perhaps the most 'peptogenic' of foods. Whether the stimulus it gives to the stomach is natural, or in the form of an improper goad or whip, certain it is that stomachs which are accustomed to this daily whip have

failed, for a time at least, to act when it was withdrawn.

"Nor is it necessary that meat should be permanently abjured, even when it ceases to become a daily necessity. The safer course, at least, is to indulge the craving whenever one is 'meat hungry,' even if, as in many cases, this be not oftener than once in several months. The rule of selection employed in the experiment was merely to give the benefit of the doubt to the non-flesh food; but even a slight preference for flesh foods was to be followed."[1]

"It goes without saying that any change in diet, unless it be a change in amount only, should be gradual. Thus, if a person has been accustomed to excessive proteid, his stomach has probably

[1] Irving Fisher, Ph.D., "The Effect of Diet on Endurance." Publications of Yale University, pp. 44–5. New Haven, Conn.

become adjusted to this condition and secretes a large amount of gastric juice. When the reduction of proteid is sudden, the gastric juice will not at first decrease in proportion, and a large part of this secretion will therefore remain unused. This uncombined acid interferes with the digestion of starch and the person feels a 'sour stomach.' A gradual reduction of proteid, on the other hand, will avoid this difficulty. The reduction may be more rapid (for the hyperacid) if the proportion of fat be increased, as fat tends to restrain the gastric secretion."[1]

All the leaders of the movement are still divided in their opinion as to whether a complete exclusion of meat, even when effected gradually, is to be recommended. Professor Chittenden's opinion is that "man is an omnivorous animal and

[1] Irving Fisher, Ph.D., "A Graphic Method in Practical Dietetics." New Haven, Conn.

Nature never intended him to subsist solely on any specific form of food to the exclusion of all others." . . . "Vegetarianism may have its virtues," he says, "as too great indulgence in flesh foods may have its serious side, but there would seem to be no sound physiological reason for the complete exclusion of any one class of foodstuffs, under ordinary conditions of life."[1] He is emphatic in declaring, however, that "a diet which conforms to the true nutritive requirements of the body must necessarily lead toward vegetable foods. In no other satisfactory way can excess of proteid be avoided and at the same time proper calorific value be obtained. This, however, does not mean vegetarianism, but simply a greater reliance upon foods from the plant kingdom, with a correspond-

[1] Chittenden, "Physiological Economy in Nutrition," p. 470.

ing diminution in the typical animal foods."[1]

To this discussion Professor Fisher has contributed a summary of a monograph by Mlle. Dr. J. Ioteyko, head of the laboratory at the University of Brussels, and Mlle. Varia Kipiani, student in science, setting forth the results of their recent investigation of the relative merits of a vegetarian and a meat diet.

"The authors have become convinced," says Professor Fisher, "that the vegetarian régime is for the most part a more rational one than the highly nitrogenous diet ordinarily prevailing in Western Europe and America. The authors quote, in behalf of their conclusions, the eminent French dietician, Armand Gautier, 'who without himself being a vegetarian, praises the good effects of the vegetarian

[1] Chittenden, "Nutrition of Man," pp. 291–2.

régime.' The authors quote Gautier as follows:—

"'The vegetarian régime, modified by the addition of milk, fat, butter, and of eggs, has great advantages. It adds to the alkalinity of the blood, accelerates oxidation, diminishes organic wastes and toxins; it exposes one much less than the ordinary régime to skin maladies, to arthritis, to congestions of internal organs. This régime tends to make us pacific beings, and not aggressive and violent. It is practical and rational.'

"The authors, while apparently classifying themselves as advocates of vegetarianism, admit that in certain cases it is necessary to prescribe meat as a 'medicament'—'just as one prescribes sometimes alcohol and other poisons.' The authors also observe that the transition to a vegetarian diet should be gradual.

"The personal history is traced of forty-three vegetarians of Brussels. Among other interesting observations is the following:—

"'For the most part the vegetarians appear younger than their age; notably the ladies are distinguished by their clear and fresh complexion.'

"The experiments conducted by Mlles. Ioteyko and Kipiani are restricted to vegetarians who have been such for several years. The experiments were, for the most part, comparisons of strength and endurance. So far as strength is concerned very little difference was discovered between vegetarians and 'carnivores.' In endurance, on the other hand, a very remarkable difference was found, the vegetarians surpassing the carnivores from 50 to 200 per cent, according to the method of measurement.

"This result agrees with the" (Professor Fisher's) "experiment on nine Yale students described in *Science.* These subjects, by dint of thorough mastication, gradually lost their taste for flesh foods. At the end of five months, while not becoming vegetarians, they had reduced their consumption of flesh foods to one-sixth of the amount to which they had originally been accustomed. Their strength remained practically stationary, but their endurance, according to the gymnasium tests, was increased on an average by over 90 per cent.

"The authors compared the endurance of seventeen vegetarians, six men and eleven women, with that of twenty-five carnivores, students of the University of Brussels. Comparing the two sets of subjects on the basis of mechanical work, it is found that the vegetarians surpassed

the carnivores on the average by 53 per cent. Comparing the two groups on the basis of the number of contractions—or, what amounts to the same thing, the length of time during which the ergograph could be continuously operated—it was found that the vegetarians could work on the ergograph two or three times as long as the carnivores before reaching the exhaustion point.

"This last result corresponds to conclusions of the present writer in an experiment in which forty-nine subjects, about half of whom were flesh-eaters and half flesh-abstainers, were compared. It was found that the flesh-abstainers had more endurance, as measured by gymnasium tests, than the flesh-eaters, to the extent of from two to three fold.

"The Brussels investigators found also that the vegetarians recuperated from fatigue far more quickly than the meat-

eaters, a result also found in the Yale experiment.

"The authors conclude by advocating a vegetarian régime as a proper system for working men, and believe that its use would reduce the accidents on railways and in industry which come from over-fatigue, increase the productivity of labour, as well as have other economic benefits.

"These investigations, with those of Combe of Lausanne, Metchnikoff, and Tissier of Paris, as well as Herter and others in the United States, seem gradually to be demonstrating that the fancied strength from meat is, like the fancied strength from alcohol, an illusion. The 'beef and ale of England' are largely sources of weakness, not strength. Whether in moderation they are harmful may still be a matter of conjecture. While the trend of recent experiments is

distinctly against the excessive use of flesh foods, there are still needed many more experiments—medical, athletic, and industrial—before the economics of diet can be established on a secure basis."[1]

In another place, Professor Fisher concludes:

"The users of low-proteid and non-flesh dietaries have far greater endurance than those who are accustomed to the ordinary American diet. . . . It may be said that, whatever the explanation, there is strong evidence that a low-proteid non-flesh or nearly non-flesh dietary is conducive to endurance. . . .

"The question of the extent to which flesh foods can be used advantageously is still open, but there can now be little question, in view of the facts which have

[1] Irving Fisher, Ph.D., "Diet and Endurance at Brussels," *Science*, N.S., vol. xxvi, No. 669, pp. 561–3, October 25, 1907.

come to light during the last few years, that the ordinary consumption of those foods is excessive."[1]

The endurance-giving qualities of a non-flesh dietary are, however, attributed by Mlles. Ioteyko and Kipiani, not to its low-proteid values, but to toxins present in animal tissue. The chemical processes that go on in the bodies of all living creatures generate substances which, in character and effect, are true poisons. These poisons serve their own good purposes in the bodily economy, and, in the healthy organism, are readily transformed into harmless substances or excreted. There is no moment in the life of a creature, however, when its tissues are wholly free from them. Therefore, when an animal is slaughtered for food

[1] Irving Fisher, Ph.D., "The Influence of Flesh-eating on Endurance," *Yale Medical Journal*, March, 1907.

and the chemical processes which would otherwise have disposed of its toxins are suddenly arrested, the poisons remain in the tissues and are devoured by the consumer along with the meat.

A person in vigorous health can usually manage to dispose of toxins taken into his body in this fashion as well as the poisons generated by his own organism, but only at the expense of a great deal of hard work. Persons who have a tendency to manufacture more poisons than they can manage conveniently—for instance, gouty and rheumatic persons who have a tendency to manufacture an excess of uric acid—are, however, almost sure to suffer unless their use of meat is limited to extremely small quantities.

Allied with these facts is the discovery that meat-eating apparently tends to increase the number and virulence of the

bacteria in the lower intestines.[1] In view of Elie Metchnikoff's recent declaration[2] that it is primarily the presence of these organisms in the colon that causes the human body to break down or wear out before its time, this fact alone would seem to add considerable weight to the argument for reduced consumption of flesh food.

In defence of their uncompromising condemnation of meat-eating, vegetarian dogmatists usually bring out the argument that the most spiritual and intellectual men of all ages have discouraged the use of animal-flesh for food; or quote from the Scriptures to prove that they have inspired authority;[3] but the leaders

[1] Chittenden, "Nutrition of Man," pp. 292 3.

[2] Elie Metchnikoff, "The Nature of Man," "The Prolongation of Life." London, William Heinemann.

[3] A favourite reference of the kind occurs in the first chapter of the book of Daniel, where it is related how the budding prophet, after having rejected the meats and wines of the king's table and subsisted on

of the new movement have considered the subject from a purely physiological view-point. On this point Professor Fisher says:

"Vegetarian fanaticism has done much to defeat its own ends. From the premise—often bolstered up by theological dogma—that flesh-eating is wrong, the inference is drawn that it must be unhygienic. This reasoning is so utterly at variance with the methods of modern science as to stamp those who use it as victims of bigoted prejudice, and to prevent any genuine scientific investigation. At present the tendency of such investigations as those of Chittenden, Mendel, Folin, Metchnikoff, Caspari, Le Fevre, Fauvel and others have a distinct trend towards a fleshless dietary.

pulse and water for ten days, was found "fairer and fatter in flesh than all the children that did eat of the king's meat," and "ten times better than all the magicians and astrologers that were in all the realm."

And yet, such are the associations of the term 'vegetarian,' that many are loath to grant even what is due to the tenets of 'vegetarianism.' The proper scientific attitude is to study the question of meat-eating in precisely the same manner as one would study the question of bread-eating."[1]

It is quite possible to overeat on proteid without making use of meat at all. The old-fashioned vegetarians who substituted for meat an equivalent of proteid derived from nuts, peas, beans, lentils—or, in the case of the so-called "lacto-vegetarians," eggs and milk and the milk products—were probably not deriving as much benefit from their abstention from meat as they should have done if they had not been so careful to replace it

[1] Irving Fisher, Ph.D., "The Influence of Flesh-eating on Endurance," *Yale Medical Journal*, March, 1907.

with non-flesh proteid—particularly as the non-flesh sources of proteid have many of the disadvantages of meat. Uric acid precursors exist in large quantities in all the legumes. The decomposition products of the "ripe" cheeses, so highly prized by epicures, are only less dangerous than those of meat. Milk is so extremely susceptible to contamination by bacteria that some persons have gone so far as to condemn it as an article of food except for nursing infants. Accordingly the restrictions in the use of meat may be applied with advantage to the meat substitutes as well.

In addition to the 60 grams or two ounces of proteid, enough carbohydrate food should be taken every day to make up a total fuel value of from 2000 to 3000 calories, according to the degree of bodily activity. "The man whose work is mainly mental," says Professor Chitten-

den, "has no real need for high fuel values in his daily ration. For such a man, a high potential energy in the daily intake of food is an incubus and not a gain. Bodily equilibrium can be maintained on far less than 3000 calories per day by the brain-worker. . . . Moreover, as our experiments have clearly indicated, even the man who is called upon to perform considerable physical work has no apparent need for a fuel value in his food of 3000 calories per day. No doubt, the man who works at hard labour for ten or twelve hours a day will require a larger intake of fats and carbohydrates, sufficient to yield even more than 3000 calories, but this is not true of the moderate worker, nor of the average man whose work is in large measure mental rather than physical."[1]

[1] Chittenden, "Physiological Economy in Nutrition," p. 476.

The following dietary, outlined by Professor Chittenden, will give the reader a general idea of the kind and amount of food required for the proper proportions of proteid and carbohydrate food, and will furnish him with a basis for working out a balanced ration for himself.

BREAKFAST

	Proteid.	Calories.
One shredded wheat biscuit .	3·15 grams	106
30 grams or 1 ounce.		
One teacup of cream . . .	3·12	206
120 grams or 4 ounces.		
One German water roll . .	5·07	165
57 grams or 2 ounces.		
Two one-inch cubes of butter .	0·38	284
38 grams or 1⅓ ounces.		
Three-fourths cup of coffee . .	0·26	—
100 grams or 3⅓ ounces.		
One fourth teacup of cream .	0·78	51
30 grams or 1 ounce.		
One lump of sugar . . .	—	38
10 grams or ⅓ ounce.		
½ ounce approx. =	12·76 grams	850

LUNCH

	Proteid.	Calories.
One teacup home-made chicken soup 144 grams or 4⅘ ounces.	5·25 grams	60
One Parker-house roll . . . 38 grams or 1⅓ ounces.	3·38	110
Two one-inch cubes of butter . . 38 grams or 1⅓ ounces.	0·38	284
One slice lean bacon . . . 10 grams or ⅓ ounce.	2·14	65
One small baked potato . . . 60 grams or 2 ounces.	1·53	55
One rice croquette . . . . 90 grams or 3 ounces.	3·42	150
Two ounces maple syrup . . . 60 grams or 2 ounces.	—	166
One cup of tea with one slice of lemon	—	—
One lump of sugar . . . . 10 grams or ⅓ ounce.	—	38
½ ounce approx. =	16·10 grams	928

DINNER

	Proteid.	Calories.
One teacup cream of corn soup . 130 grams or 4⅓ ounces.	3·25 grams	72
One Parker-house roll . . . 38 grams or 1⅓ ounces.	3·38	110
One-inch cube of butter . . . 19 grams or ⅔ ounce.	0·19	142
One small lamb chop, broiled lean meat . . . . . . 30 grams or 1 ounce.	8·51	92

	Proteid.	Calories.
One teacup of mashed potato . 167 grams or 5⅗ ounces.	3·34	175
Apple - celery lettuce salad with mayonnaise dressing . . . 50 grams or 1⅗ ounces.	0·62	75
One Boston cracker, split, 2 inches diameter . . . . . 12 grams or ⅓ ounce.	1·32	47
One half-inch cube American cheese 12 grams or ⅓ ounce.	3·35	50
One half teacup of bread pudding . 85 grams or 3 ounces.	5·25	150
One demitasse coffee . . .	—	—
One lump of sugar . . . . 10 grams or ⅓ ounce.	—	38
1 ounce approx. =	29·21	951

"The grand totals for the day, with this dietary, amount to 58·07 grams of proteid (2 oz. approx.) and 2729 calories. It is of course understood that these figures are to be considered as only approximately correct, but the illustration will suffice, perhaps, to give a clearer understanding of the actual quantities of food involved in a daily ration approaching the requirements for a man of 70 kilo-

grams (154 pounds) body-weight. Further, there may be suggested by the figures given for proteid and fuel value of the different quantities of foods, a clearer conception of how much given dietary articles count for in swelling the total value of a day's intake. Moreover, it is easy to see how the diet can be added to or modified in a given direction. If a little more proteid is desired without changing materially the fuel value of the food a boiled egg can be added to the breakfast, for example. An average-sized egg of 53 grams (2 oz.) contains 6·9 grams of proteid, while it will increase the food value of the fuel by only 80 calories. Or, if more vegetable proteid is wished for, a soup of split-peas can be introduced, without changing in any degree the calorific value of the diet. Thus, one teacup of split-pea soup (144 grams, or 4$\frac{2}{3}$ oz.) contains 8·64 grams of

proteid, while the fuel value of this quantity may be only 94 calories. The addition of one banana (160 grams, $5\frac{1}{3}$ oz.) will increase fuel value 153 calories, but will add only 2·28 grams of proteid. If it is desired to increase fuel value without change in the proteid-content of the food, recourse can always be had to butter, fat of meat, additional oil in salads, or to syrup and sugar.

"Such a menu as is roughly outlined, however, has perhaps special value in emphasizing how largely the proteid intake is increased by food other than meats, and which are not conspicuously rich in proteid matter. All wheat products, for example, while abounding in starch, still show a large proportion of proteid. Thus, shredded wheat biscuit (1 ounce), which is a type of many kindred wheat preparations, from bread and biscuit to the many so-called break-

fast foods, yields about 3 grams of proteid per ounce and approximately 100 calories. Even potato, which is conspicuously a carbohydrate food owing to its large content of starch, yields of nitrogen the equivalent of at least three-fourths of a gram of proteid per ounce. If larger volume is desired without much increase in real food value, there are always available green foods, such as lettuce, celery, greens of various sorts, fruits, such as apples, grapes, oranges, etc. Too great reliance on meats as a type of concentrated food, on the other hand, augments largely the intake of proteid food, and adds a relatively small amount to the fuel value of the day's ration." [1]

The following specimen meals, taken at random from among the dietaries used by the subjects of Professor Chittenden's

[1] Chittenden, "Nutrition of Man," pp. 280-2.

experiments, are given here as actual examples of dietaries in which the proportions and amounts of the various kinds of food are properly balanced.[1]

Professor Chittenden[2]

BREAKFAST—1 cup coffee (demitasse), 1/8 teacup cream, 1 teaspoonful sugar.

LUNCH—1 shredded wheat biscuit, 1/2 teacup cream, 1 teacup tea, 1 teaspoonful sugar, 1 small piece of apple-pie, 2 wheat gems, 1/2-inch cube butter.

DINNER—1 teacup milk-celery soup, 1 slice bread, a pat of butter, lettuce sandwich, small triangle of lemon pie.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Coffee, 3 1/3 oz.		100	×	0·042	0·042
Cream, 4 4/5 oz.	25 + 118 =	143	×	0·43	0·615
Sugar, 5/8 oz.	8 + 7 + 10 =	25	×	0·00	0·000
Shredded wheat biscuit, 1 oz.		29	×	1·76	0·510
Wheat gems, 2 oz. . . .		60	×	1·17	0·702

[1] The quantities of food in the specimen meals, which were indicated by Professor Chittenden by their weight in grams, have been weighed out for this book into portions that can be more readily estimated by the average man. As the food used for this purpose was not that used by Professor Chittenden, the estimates must be understood to be mere approximations.—G. B.

[2] Chittenden, "Physiological Economy in Nutrition," p. 38.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Butter, 1/3 oz.	8 + 1 =	9	×	0·10	0·009
Tea, 6 2/3 oz.	100 + 100 =	200	×	0·048	0·096
Apple pie, 3 1/3 oz.	. . .	102	×	0·75	0·765
Milk-celery soup, 4 2/3 oz.	. .	140	×	0·42	0·588
Bread, 1/2 oz.	. . . .	15	×	1·36	0·204
Lettuce sandwich, 2 oz.	. .	62	×	1·02	0·632
Lemon pie, 3 2/3 oz.	. . .	109	×	0·82	0·894
Total nitrogen in food	. . .				5·057

Fuel value of the food, 1594 calories.

Professor Mendel[1]

BREAKFAST—2 thin slices bread (average baker's loaf), 2½ teaspoonfuls sugar, 1 teacup coffee.

LUNCH—6 slices bread, 1 large sweet potato, 1 glass milk, 1 teaspoonful sugar, 1 small saucer peach preserve.

DINNER—6 slices bread, 1 potato, 1 teacup tomato puree, 1 tablespoonful baked beans, 1 small triangle lemon pie, 1 teacup coffee, 3 teaspoonfuls sugar.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Bread, 7½ oz.	40 + 95 + 90 =	225	×	1·75	3·94
Sugar, 1 2/3 oz.	20 + 7 + 21 =	48	×	0·00	0·00
Coffee (breakfast), 7 oz.	. .	210	×	0·096	0·20
Sweet potato, 4 1/3 oz.	. . .	130	×	0·31	0·40
Milk, 8 1/3 oz.	. . . .	250	×	0·51	1·27
Peach preserve, 3 oz.	. .	93	×	0·09	0·08
Potato, 3 1/3 oz.	. . . .	100	×	0·36	0·36
Tomato puree, 4½ oz.	. . .	135	×	0·33	0·45

[1] Chittenden, "Physiological Economy in Nutrition," p. 61.

FOOD.	Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Baked beans, 2½ oz. . . .	75	×	1·30	0·98
Lemon pie, 3⅝ oz. . . .	110	×	0·61	0·67
Coffee (dinner), 7 oz. . . .	210	×	0·13	0·27
Total nitrogen in food				8·62

Fuel value of the food, 1828 calories.

Mr. Beers[1]

Breakfast—2 saucers oatmeal, 1 inch-cube butter, ⅓ teacup cream, 5 teaspoonfuls sugar, 1 teacupful coffee.

Lunch—5 thin slices bread, 1 inch-cube butter, 1 large boiled potato, 1 glass milk.

Dinner—4 slices bread, 1 inch-cube butter, 1 heaped tablespoonful baked beans, saucer cranberry sauce, 1 teacupful coffee, 3 teaspoonfuls sugar.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Oatmeal, 10 oz. . . .		229	×	0·60	1·794
Butter, 1⅓ oz.	19+11+12=	42	×	0·088	0·036
Cream, 2¼ oz.		71	×	0·47	0·333
Sugar, 2 oz.	41+21=	62	×	0·00	0·000
Coffee (breakfast), 7 oz. . .		210	×	0·12	0·252
Bread, 4½ oz.	79+56=	135	×	1·65	2·227
Boiled potato, 5⅙ oz. . .		155·2	×	0·39	0·605
Milk, 8⅓ oz.		250	×	0·55	1·375
Baked beans, 3⅓ oz. . .		100	×	1·40	1·400
Cranberry sauce, 5 oz. . .		150	×	0·04	0·060
Coffce (dinner), 7 oz. . .		210	×	0·11	0·231
Total nitrogen in food . . .					8·313

Fuel value of the food, 1723 calories.

[1] Chittenden, "Physiological Economy in Nutrition," p. 115.

Mr. Oakman, member of the soldier detail[1]

BREAKFAST—1 saucer boiled rice, ½ glass milk, 3 teaspoonfuls sugar, 1 large baked potato, 1 inch-cube butter, 1 coffee-cup coffee.

DINNER—2 heaped tablespoonfuls baked spaghetti, 5 slices bread, 1 small saucer boiled tomato, 1 small triangle apple pie, 2 average slices bacon, 1 coffee-cup coffee.

SUPPER—3 biscuits, 2 average slices fried bacon, 5 tablespoonfuls fried sweet potato, 1 inch-cube butter, 1 coffee-cup tea.

FOOD.	Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Boiled rice, 6 oz. . . .	175	×	0·34	0·595
Milk, 4 oz.	125	×	0·55	0·687
Sugar, 1 oz.	25	×	0·00	0·000
Baked potato, 5 oz. . . .	150	×	0·34	0·510
Coffee (breakfast), 11⅔ oz. .	350	×	0·082	0·287
Butter, 1 oz. 10 + 20 =	30	×	0·16	0·480
Spaghetti, 8⅓ oz . . .	250	×	0·73	1·825
Mashed potato, 8⅓ oz. . .	250	×	0·30	0·750
Bread, 2½ oz.	75	×	1·61	1·207
Tomato, 5 oz.	150	×	0·16	0·240
Apple pie, 3⅔ oz. . . .	112	×	0·46	0·515
Biscuit, 6 oz.	175	×	1·21	2·117
Fried bacon, ⅔ oz. . . .	20	×	3·80	0·760
Fried sweet potato, 5 oz. . .	150	×	0·22	0·330

[1] Chittenden, "Physiological Economy in Nutrition," p. 224.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Tea, 11⅔ oz.		350	×	0·06	0·210
Coffee (dinner), 11⅔ oz.		350	×	0·11	0·385
Total nitrogen in food					10·466

Fuel value of the food, 2670 calories.

Mr. Donahue, one of the Yale athletes[1]

Breakfast—1 banana, 1 saucer boiled Indian meal, ¼ teacup cream, 2½ teaspoonfuls sugar, 4 thin slices bread, 1 inch-cube butter.

Lunch—4 thin slices bread, 1 inch-cube butter, 1 small lamb chop, 1 heaped tablespoon potato-croquette, 1 large saucer tomato, 1 saucer water-ice, 2½ teaspoonfuls sugar.

Dinner—½ teacup bean soup, 3½ tablespoonfuls fried potato, ½ egg, 1 average slice bacon, 1 salad-plate lettuce, 1 cup coffee (demitasse), ¼ teacup cream, 2½ teaspoonfuls sugar, 6 large stewed prunes and juice.

FOOD.		Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Bread, 2 oz.		59	×	1·65	0·964
Butter, 1 oz.	16 + 13 =	29	×	0·15	0·044
Banana, 3½ oz.		106	×	0·23	0·244
Boiled Indian-meal, 5 oz.		150	×	0·17	0·255
Sugar, 2 oz.	21 + 14 + 21 =	56	×	0·00	0·000
Cream, 3½ oz.	50 + 50 =	100	×	0·43	0·430
Bread, 2 oz.		55	×	1·82	1·001
Potato croquette, 3½ oz.		105	×	0·71	0·746

[1] Chittenden, "Physiological Economy in Nutrition," p. 379.

FOOD.	Grams.		Per cent. Nitrogen.	Total Nitrogen. Grams.
Lamb chops, 1⅓ oz.	37	×	4·63	1·713
Tomato, 7 oz.	213	×	0·17	0·367
Water-ice, 4⅔ oz.	143	×	0·012	0·017
Prunes, 8⅓ oz.	247	×	0·16	0·395
Bean soup, 3⅓ oz.	100	×	1·21	1·210
Fried potato, 3⅓ oz.	100	×	0·60	0·600
Egg, ⅔ oz.	22	×	2·27	0·499
Bacon, ⅓ oz.	10	×	3·05	0·305
Salad, 2 oz.	63	×	0.21	0·132
Coffee, 3⅓ oz.	100	×	0·06	0·060
Total nitrogen in food				8·992

Fuel value of the food, 2294 calories.

Professor Chittenden adds to the specimen meals used in his own experiments the following dietary, which was adopted by a Scotch physician, Dr. Aran Coirce, as a test of the low-proteid theory.

Breakfast—Oatmeal cakes, bread and butter, about 1 cubic inch of cheese or bloater paste, marmalade, and one breakfast cup of tea.

Lunch—Same as breakfast, with occasionally a boiled egg, sometimes coffee instead of tea.

Dinner—Thick soup containing vegetables, with bread, followed by suet pudding or fruit tart ; or vegetable stew, containing 2 or 3 ounces of meat, with boiled potatoes, followed by milk pudding and jam, and occasionally a cup of black coffee.

"The result was that I was relieved of a lifelong tendency to acid dyspepsia and occasional sick headache," says Dr. Coirce; "my fitness for work, my appetite and relish for food were increased, without any diminution, but rather a slight increase in weight. My practice extends over a wide area of rough mountainous country involving long journeys on cycle, on foot, driving, and in open boats, in fair and foul weather. The muscular exertion and endurance necessary for the work would seem to require a large proportion of proteid and a generous diet altogether, but since I began to experiment I have suffered less than formerly from fatigue, and seem to eat in all a smaller quantity of food." [1]

These weekly bills of fare in actual use in two families which have adopted

[1] Chittenden, "Nutrition of Man," pp. 285-6.

the new plan of diet are given here as indicating the wide range of variety possible in a diet that has been brought into strict conformation with true physiological needs.

SUNDAY[1]

Breakfast

2 tablespoons of stewed tunny fish
1 piece of toast
1 potato cake
1 tablespoonful of oatmeal and cream
8 ounces of strong, black coffee and cream

Lunch

Nothing

Tea

4 small crackers
1 cup of tea

Dinner

1 very small piece of roast lamb
1 sauceplate of macaroni
1 sauceplate of apple tapioca and cream
1 small piece of gingerbread
2 small cups of tea

Supper (11 P.M.)

1 plate of ice cream
1 small piece of cake

[1] Goodwin Brown, "The Secret of Efficiency," *The New York Times*, June 16, 1907.

MONDAY

Breakfast

1 heaped tablespoonful stewed lamb
2 small buckwheat cakes
1 tablespoonful Scotch oatmeal and cream
8 ounces strong black coffee and cream

Lunch

4 crackers
2 small pieces of bread
2 very small codfish cakes
very small piece of ham

Dinner

1 heaped tablespoonful stewed lamb
½ sauce-dish stewed corn
1 tablespoonful tapioca pudding
1 tablespoonful wine jelly and cream
2 cups of tea

Supper

1 milk cracker
1 small Deerfoot sausage
⅓ piece mince-pie

TUESDAY

Breakfast

5 small cubes fried liver
1 piece of toast
1 tablespoonful Scotch oatmeal and cream

Dinner

Plateful corn soup
1 heaped tablespoonful boiled codfish and potatoes
2 tablespoonfuls wine jelly and cream
2 cups of tea

WEDNESDAY

Breakfast

6 small cubes of fried liver
½ slice toast
1 small codfish ball
1 heaped tablespoonful Scotch oatmeal and cream
8 ounces of strong coffee without cream

Dinner

5 raw oysters
1 plate clear turtle soup
½ portion baked fish
1 small croquette
½ French roll
2 olives
½ portion chicken salad
½ plate wine jelly
1 small portion ice cream

THURSDAY

Breakfast

1 small piece of fried bacon
1 fried egg
1 buckwheat cake
½ sauce-plate Scotch oatmeal and cream
8 ounces strong coffee with cream

Lunch

Nothing

Dinner

1 heaped tablespoonful cornbeef hash
1 heaped tablespoonful baked beans
1 portion of lettuce and onion salad
½ plate of stewed onions
1 slice bread and butter
1 sauce-plate of sliced onions
2 cups of tca

FRIDAY

Breakfast

1 thin slice of bacon
5 small cubes of fried liver
2 small buckwheat cakes
1 heaped tablespoonful Scotch oatmeal
8 ounces strong black coffee with cream

Lunch

Piece of steak size of finger
1 tablespoonful mashed potato
½ sauce-plate of stewed peas
1 plate of thin bean soup
1 cake
1 sauce-plate of ice cream

Dinner

1 slice cold fried bacon

SATURDAY

Breakfast

1 slice of toast covered with stewed chopped meat
½ sauce-plate Scotch oatmeal with cream
8 ounces strong coffee with cream

Dinner

7 small smoked Norway sardines
1 tablespoonful tunny fish
2 small crackers

SUNDAY [1]

Breakfast

Rolls and coffee

Lunch

Cereal and cream
Grapefruit

Dinner

Scrambled eggs
Lettuce salad
Corn muffins
Stewed rhubarb
Crackers and cheese

[1] Frances Maule Björkman, "A Practical Experiment in Fletcherism," *The World's Work* (American edition), February, 1908.

MONDAY

Breakfast

Rolls and coffee

Lunch

Lettuce salad
Wheat wafers
Orange

Dinner

Bacon and eggs
Stewed corn
Rolls
Fruit salad

TUESDAY

Breakfast

Oaten wafers and coffee

Lunch

Strawberries and cream
Corn muffins

Dinner

Poached eggs
Boiled onions
Graham gems
Bananas and cream

WEDNESDAY

Breakfast

Oaten wafers and coffee

Lunch

Cereal and cream
Orange

Dinner

New asparagus in cream
Lettuce salad
Rolls
Stewed prunes

THURSDAY

Breakfast

Coffee

Lunch

Cream cheese and bar le duc jelly

Dinner

Baked beans
Brown bread
Tomato salad
Stewed rhubarb

FRIDAY

Breakfast

Coffee

Lunch

Cereal and cream
Figs

Dinner

Baked beans
Stewed tomatoes
Brown bread
Fruit salad

SATURDAY

Breakfast

Nothing

Lunch

Strawberries and cream

Dinner

New asparagus in cream
Lettuce and cucumber salad
Rolls
Stewed apples

The following table, taken from Professor Chittenden,[1] will give the reader

[1] "Nutrition of Man."

a general idea of where 60 grams or 2 ounces of proteid are to be found:

SIXTY GRAMS OR TWO OUNCES OF PROTEID ARE CONTAINED IN

	Fuel Value Calories.
One-half pound fresh lean beef, loin	308
Nine hens' eggs	720
Four-fifths pound sweetbread	660
Three-fourths pound fresh liver	432
Seven-eighths pound lean smoked bacon	1820
Three-fourths pound halibut steak	423
One-half pound salt codfish, boneless	245
Two and one-fifth pound oysters, solid	506
One-half pound pale cheese	1027
Four pounds whole milk (two quarts)	1300
Five-sixths pound uncooked oatmeal	1550
One and one-fourth pounds shredded wheat	2125
One pound uncooked macaroni	1665
One and one-third pounds white wheat bread	1520
One and one-fourth pounds crackers	2381
One and one-third pounds flaked rice	2807
Three-fifths pound dried beans	963
One and seven-eighths pounds baked beans	1125
One-half pound dried peas	827
One and eleven-twelfths pounds potato chips	5128
Two-thirds pound almonds	2020
Two-fifths pound pine nuts, pignolias	1138
One and two-fifths pounds peanuts	3584
Ten pounds bananas, edible portion	4600
Ten pounds grapes	4500
Eleven pounds lettuce	990
Fifteen pounds prunes	5550
Thirty-three pounds apples	9570

"The figures in this table are instructive in many ways. First, it is to be noted that the daily proteid requirement of sixty grams can be obtained from one-half pound of lean meat (uncooked), of which the loin steak is a type. Subject to some variations in content of water, an equivalent weight of lean flesh of any variety, lamb, veal, poultry, etc., will furnish approximately the same amount of proteid. With fish, such as halibut steak, and with liver, three-quarters of a pound are required; while with sweetbreads, four-fifths of a pound are needed to furnish the requisite amount of proteid. Of salt codfish, one-half pound will provide the same amount of proteid as an equivalent weight of fresh beef; while with lean smoked bacon the amount rises to seven-eighths of a pound. Among the vegetable products, it is to be observed that dried peas and

beans, almonds and pine-nuts are as rich in proteid as the above-mentioned animal foods, essentially the same weights being called for to provide the daily requirement of proteid. The same is true of cheese, the variety designated having such a composition that one-half pound is the equivalent, so far as the content of proteid is concerned, of a like amount of fresh beef. We must not be unmindful of the fact previously mentioned, however, that there are differences in digestibility among these various foodstuffs which tend to lower somewhat the availability of the vegetable products, also of the cheese, thereby necessitating a slight increase in the amount of these foods required to equal the value to the body of lean meat.

"Secondly, passing to the other extreme in our list, we find indicated types of foods exceedingly poor in proteid,

such as the fruits; notably, bananas, grapes, prunes, apples, etc., also lettuce, and in less degree potatoes. These are the kinds of food that may legitimately attract by their palatability, but do not add materially to our intake of proteid even when consumed in relatively large amounts. Thirdly, we see clearly indicated a radical difference between the animal foods and those of vegetable origin, in that with the former the fuel value of the quantity necessary to furnish the sixty grams of proteid is very small, as compared with a like amount of the average vegetable product. One-half pound of lean meat, for example, with its 60 grams of proteid, has a fuel value of only 308 calories, while two-thirds of a pound of almonds has a fuel value of 2020 calories, and one-half pound of dried peas 827 calories. Naturally, this is mainly a question of the proportion of

fat or oil present. With fat meat, as in bacon, the calorific value rises in proportion to increase in the amount of fat, the proteid decreasing in greater or less measure.

"The main point to be emphasized in this connection, however, is that a high-proteid animal food, like lean meat, eggs, fish, etc., obviously cannot alone serve as an advantageous food for man. We see at once the philosophy of a mixed diet. Let us assume that our average man of 70 kilograms body-weight needs daily 2800 calories. On this assumption, if he were to depend entirely upon lean beef for his sustenance, he would require daily four and a half pounds of such meat, which amount would furnish nine times the quantity of proteid needed by his system. The same would be more or less true of other kindred animal products. On the other hand, certain vegetable

foods on our list, such as flaked rice, crackers, and shredded wheat, contain proteid, with carbohydrate and fat, in such proportion that the energy requirement would be met essentially by the same quantity as served to furnish the necessary proteid. Passing to the other extreme among the vegetable products, as in potatoes and bananas, for example, we find fuel value predominating largely over proteid content. The ideal diet, however, is found in a judicious admixture of foodstuffs of both animal and vegetable origin. Wheat bread, reinforced by a little butter or fat bacon to add to its calorific value, shredded wheat with rich cream, crackers with cheese, bread and milk, eggs with bacon, meat with potatoes, etc.: the common, everyday household admixtures provide combinations which can easily be made to accord with true physiological requirements. The same

may be equally true of the more complicated dishes evolved by the high art of modern cookery."[1]

The following table, made out by Professor Fisher, will indicate the amount of carbohydrates necessary to bring the fuel value of the food up to the amount required:[2]

PORTION OF FOOD CONTAINING 100 CALORIES	Weight of 100 Calories		Per cent. of		
	Grams	Ozs.	Proteid	Fat	Carbohydrate
Clams (12 to 16 raw)	210	7·4	56	8	36
Oysters (12 raw)	193	6·8	49	59	00
Beef soup	380	13	69	14	17
Bean soup, very large pl.	150	5·4	20	20	60
Cream of celery soup (2)	180	6·3	16	47	37
Beef boiled (small serving)	36	1·3	40	60	00
Roast beef (½ serving)	18.5	·65	12	88	00
Broiled lamb chop (small)	27	·96	24	76	00
Roast lamb (ord. serving)	50	1·8	40	50	00
Boiled ham (sm. serving)	20.5	·73	14	86	00
Baked ham (sm. serving)	27	·96	19	81	00
Boiled eggs (1 large egg)	59	2·1	32	68	00
Omelette	94	3·3	34	60	6
Baked beans, sm. sidedish	75	2·66	21	18	61
Lima beans, large sidedish	126	4·44	21	14	75

[1] Chittenden, "Nutrition of Man," pp. 274–7.

[2] Irving Fisher, Ph. D., "A Graphic Method in Practical Dietetics."

PORTION OF FOOD CONTAINING 100 CALORIES	Weight of 100 Calories Grams	Ozs.	Per cent. of Pro-teid	Fat	Carbo-hydrate
Beets, 3 servings . .	245	8·7	2	23	75
Carrots, 2 servings .	164	5·81	10	34	56
Onions, 2 large servings	240	8·4	12	40	48
Peas, 1 serving . .	85	3	23	27	50
Baked potato, 1 large .	86	3	23	27	50
Boiled potato, 1 large .	102	3·62	11	1	68
Mashed potato, 1 serving	89	3·14	10	25	65
Potato chips, ½ serving .	17	·6	4	63	33
Sweet potato, ½ av. potato	49	1·7	6	9	85
Spinach, 2 ord servings .	174	6·1	15	66	19
Tomatoes, fresh (4) . .	480	15	15	16	69
Brown bread thick slice .	43	1·5	9	7	84
White bread thick slice .	38	1·3	13	6	81
Hominy, large serving .	120	4·2	11	2	87
Macaroni, ord. serving .	110	3·85	14	15	71
Oatmeal, one-half serving	159	5·6	18	7	75
Rice, ord. cereal dish .	87	3·1	10	1	89
1 large Vienna roll .	35	1·2	12	7	81
Shredded wheat 1 biscuit	27	·94	13	4·5	82·5
Butter, ordinary ball .	12·5	·44	·5	99·5	00
Buttermilk, 1½ glass .	275	9·7	34	12	54
Cheese, 1½ cu. in. . .	122	·77	25	73	2
Cottage cheese, 4 cu. in. .	89	3·12	76	8	16
Cream cheese, 1½ cu. in. .	23	·82	25	73	2
Neufchatel cheese, 1½ cu. in.	29·5	1·05	22	76	2
Swiss cheese, 1½ cu. in. .	23	·8	25	74	1
Cream, ¼ ord. glass . .	49	1·7	5	86	9
Milk, small glass . .	140	4·9	19	52	29
Honey, 4 teaspoonfuls .	30	1·05	1	0	99
Olives, green 7 . .	32	1·1	1	84	15
Olives, ripe 7 . .	38	1·3	2	91	7

PORTION OF FOOD CONTAINING 100 CALORIES	Weight of 100 Calories		Per cent. of		
	Grams	Ozs.	Pro-teid	Fat	Carbo-hydrate
Sugar gran. 3 tablespoons	24	·86	0	0	100
Maple syrup, 4 tablespoons	35	1·2	0	0	100
Chocolate, layer cake ½ .	28	·98	7	22	71
Custard, 1 ord. cup . .	122	4·29	26	56	18
Doughnuts, ½ . .	23	·8	6	45	49
Dates, 3 large . .	28	·99	2	7	91
Figs, 1 large . . .	31	1·1	5	0	95
Prunes, 3 large . .	32	1·14	3	0	97
Apples, 2 . . .	206	7·3	3	7	90
Apple-sauce, ord. serving .	111	3·9	2	5	93
Banana, 1 large . .	100	3·5	5	5	90
Oranges, 1 large orange .	270	9·4	6	3	91
Peaches, 3 . . .	290	10	7	2	91
Pears, 1 large . . .	173	5·40	4	7	89
Strawberries, 2 servings .	260	9.1	10	15	75
Almonds, 8 . . .	15	·53	13	77	10
Brazil nuts, 3 . . .	14	·49	10	86	4
Peanuts, 13 . . .	18	·62	20	63	17
Pine nuts, 80 . . .	16	·56	22	74	4
Walnuts, 6 Cal. . .	14	·48	10	83	7

The attitude of the originators of the new dietetics towards the articles of diet which are not foods in the proper sense of the term, but which are used for their stimulating effects or for their flavouring qualities, is indicated by the claim that the practice of the system tends to lead

to their rejection by taste and appetite. The habitual use of an artificial whip keeps the body running at a higher speed than it can afford, and wears out the organs and tissues before their time. However, no serious and lasting evils of a positive character can be attributed to a moderate use of tea, coffee, and chocolate, except in the case of a few persons upon whom they act as a poison.

Theine or caffeine, the active principle in tea and coffee, is a powerful stimulant to the heart, kidneys, and nervous system.[1] Fifteen grains will banish not only the desire for but the possibility of sleep for a whole night or more, and enable the user to do the best mental work of which his brain is capable for hours at a stretch. However, besides this stimulant—which may be invaluable at times—tea and coffee contain methyl

[1] C. W. Saleeby, M.D., *Worry*, p. 102.

purins and tannin, a substance which has a tendency to interfere with digestion by "tanning" the proteids of the food somewhat as tannic acid tans leather. Some of the troubles arising from the excessive use of tea and coffee spring, not from the stimulating qualities they contain, but from their xanthin and tannic acid, although the over-stimulation of large amounts of caffeine and theine are also responsible for the ill-effects of excessive tea-drinking.

Chocolate is not generally recognized as a stimulant, but it contains a drug called theo-bromine, similar in its effects to caffeine and theine, but of a somewhat milder character.

Authorities differed widely in the past as to the position that alcohol should occupy in the food scale. To-day there is hardly a physiologist or physician who has a single good word to say for its use.

Many authorities flatly class it as a poison.

But even if alcohol should have some small food value, it is certain that alcoholic liquors of every kind have none whatever aside from the alcohol which they contain. Even the highly advertised malt beers are to be gauged for their food value by their alcoholic percentages alone. Aside from this, the qualities that differentiate one alcoholic beverage from another are mere matters of flavouring.

All condiments are to be classed with stimulants: their function is to accelerate the digestive processes by means of an artificial goad. Therefore, while they may be useful in cases of impaired digestion, they are not only useless but positively injurious to a perfectly healthy organism.

It is probable that there is a physio-

logical demand for a certain amount of salt when the diet consists chiefly of vegetables, owing to the fact that the potassium salts existing in most vegetable foods have a tendency to withdraw sodium from the organism; but there is no need for, and there may be decided disadvantage in, the amounts of salt ordinarily consumed. In a diet conforming with the specimen meals given in the preceding pages, a few grams a day—say from five to fifteen, according to the character of the food—are enough to meet all real needs.[1]

Within the last year or two a great deal has been written and said about the stimulating properties of sugar, and there seems to be no doubt that the higher forms of sugar—and even the lower forms, if properly treated in the mouth—are absorbed with less effort and give

[1] Chittenden, "Nutrition of Man," pp. 299-300.

off their contained energy more quickly than any other form of food. It is now common knowledge that an army can march further and fight harder on candy than on beef, and in recognition of this fact, chocolate tablets form an integral part of all regular rations. The United States Government, recognizing the fact that the more candy a man eats the less whiskey he drinks, makes a practice of shipping tons of pure candy to its soldiers in the Philippines. The readers of Bernard Shaw will recall the use made of these facts in the comedy "Arms and the Man."[1] A starving soldier, taking refuge from pursuit by his enemies in the room of a young girl, beseeches her to give him some chocolate which he sees on her table, and meets her scornful comments on the effeminacy of his diet with the

[1] Bernard Shaw, "Arms and the Man." Brentano's, New York.

declaration that all old campaigners can be recognized by the fact that they carry chocolate creams in their holsters instead of pistols.

Unfortunately, however, the form in which sugar is most commonly used is the particular form in which it is least acceptable to the body. The common domestic product distilled from the cane, the beet, and the maple—to which chemistry gives the name of sucrose—is, in fact, not a food at all, but a food element. Before it can be used by the body it must undergo the complete process of starch digestion. The first step in this process is, as we have seen, the conversion of the starch into maltose by the action of saliva in the mouth. This is where the trouble comes in. Starchy foods can be held in the mouth, and chewed until the change into maltose has been completed. Sugary foods, on account of

their solubility, are extremely likely to escape from the mouth and slip down the throat before they have been acted upon by the saliva. Therefore, not having been properly prepared for the stomach, they are almost sure to set up more or less fermentation when they reach it.

There are two ways out of this dilemma: one is to take particular pains with the insalivation of sweets, and the other is to get one's sugar in forms other than sucrose. Malt sugar can now be purchased from manufacturers of health foods, and glucose—a readily assimilable form of sugar derived from corn, and used largely in the adulteration of honey—is a common article of commerce. Levulose, which approaches closely the form of sugar found in the blood, is contained in honey and all sweet fruits.

Unquestionably the best form in which sugar can be taken is in these gifts of nature. Honey was the only sweet known to the ancients, and was one of their great staple foods. In these modern times physicians and physiologists have rediscovered its virtues, and many of them are attempting to rescue it from the subordinate position to which it has fallen by urging its use as a substitute for cane sugar.

Physicians and physiologists are agreed that there is no article of food more valuable than fruit. Professor Chittenden gives the preference to oranges, grapes, prunes, dates, plums and bananas. In a lesser degree he recommends peaches, apricots, pears, apples, figs, strawberries, raspberries, and blueberries. When carefully masticated or when thoroughly cooked, apples may be placed in the first rank, but when swallowed raw in large

pieces they are likely to prove indigestible.[1]

The use of sucrose in excessive quantities or without due attention to insalivation — particularly in the case of sedentary people—brings in its train a long series of ills, such as catarrh of the mucous membranes of the whole body, flatulence, insomnia, sour stomach, obesity and biliousness; and it may even lead to serious disorders such as jaundice and diabetes. Used with ordinary precaution, however, it is undoubtedly one of the most valuable of foods.

The old-fashioned theory that certain foods contain special magical properties that are "good for" specific purposes in the bodily economy has no foundation in fact. Carrots are not "good for" the complexion, celery is not "good for" the nerves, fish is not a brain food. As we

[1] Chittenden, "Nutrition of Man," p. 291.

have seen, all foods are made up of a relatively small number of simple elements in varying proportions.

A given food may contain more of certain elements than others, but hardly in sufficient quantities to endow it with medicinal powers. The salts in carrots and celery as well as in many other vegetables are unquestionably useful in regulating and controlling the processes by which food is built up into healthy tissues, but they are incapable of restoring diseased tissue. Fish is supposed to be good for the brain because both fish and brain tissue contain phosphorus. When it is remembered, however, that before any substance becomes available to the body, it must be changed into the particular form of that substance which the body can use, it will readily be seen that the phosphorus which the brain requires may possibly be obtained more

readily from foods which contain less phosphorus than fish.

In working out the dietary according to the new principles, a number of factors besides the character of the food and the idiosyncrasies of the individual should be taken into consideration. "The season of the year, the climate, the degree of activity, the state of health, all present special conditions which demand particular dietetic treatment," says Professor Chittenden. "In hot summer weather, for example, there is plainly less need for food than in the cold winter season, especially for fat with its high calorific value. During the cold part of the year, the lower temperature of the surrounding air, with the tendency toward greater muscular activity, calls for more extensive chemical decomposition in order to meet the demand for heat and the energy of muscular con-

traction. There is perhaps no special reason for any material change in the amount of proteid food consumed in the two seasons, except in so far as it seems desirable at times to take advantage of the well-known stimulating properties of proteid to whip up the general metabolism of the body, in harmony with the principle that all metabolic processes may need spurring to meet the demands of a greatly lowered temperature in the surrounding air.

"Fuel value, however, should be increased somewhat during the winter months in our climate. Fat promises the largest amount of energy, but there is more of a tendency to store excess of fat than of carbohydrate, hence the latter foods have certain advantages as a source of the additional energy needed during cold weather. In warm weather it should be our aim to diminish unnecessary heat

production as much as possible, though it must be remembered that the body calls for an adequate amount of food. Lighter foods, however, may be advantageously employed, such as fruits, vegetables, fresh fish, etc. Fats, and fat meats especially are to be avoided, not only because there is no specific need for them, but particularly on account of the greater sensitiveness of the gastro-intestinal tract during the hot seasons of the year, that is liable to result in a disturbance whenever an undue quantity of rich food or heavy food is taken. Further, in hot summer weather we may advantageously live more largely on foods served cold, and thereby avoid the heat ordinarily introduced into the body by hot fluids and solids. . . .

"In old age, there is naturally a slowing down of the metabolic processes, and both nitrogen equilibrium and body equilibrium can be satisfactorily main-

tained by a relatively small intake of food and with gain to the body; but there is every reason to believe that economy in proteid food can be more advantageously adopted than economy in non-nitrogenous foodstuffs."[1]

In conclusion it should be emphasized that there is nothing in the new conception of diet that requires a man to do or not to do anything that sets him apart from his fellows and marks him out as a crank. Mankind has probably risen to the commanding position which it occupies to-day because it has always been able to subsist on all classes of food. Therefore, it seems hardly rational for man to cut himself off, absolutely and uncompromisingly, from any one of the great food staples of the race. There is no article of diet—with the possible exception of alcohol—that, taken in

[1] Chittenden, "Nutrition of Man," pp. 296–7.

moderation, can be a source of danger or disease. The method which accords best with the truths of science as well as with the promptings of common sense is to eat temperately of the foods that individual experience have proved to be most pleasing to the appetite and acceptable to the system. As Professor Chittenden puts it:

"The master words which promise help in the carrying out of an intelligent plan of living are moderation and simplicity; moderation in the amount of food consumed daily, simplicity in the character of the dietary, in harmony with the old saying that man "eats to live and not lives to eat." In so doing there is promise of health, strength, and longevity, with increased efficiency, as the reward of obedience to Nature's laws." [1]

[1] Chittenden, "Nutrition of Man," p. 301.

CHAPTER V

Is a Low-Proteid Diet Suitable for Everyone?

THE application of the results of scientific experiments to the details of everyday life is a matter of considerable difficulty. Anyone who has undergone the laboratory training necessary for the attainment of technical methods and has endeavoured to solve some of the problems of existence upon experimental lines, is aware of the value of restraining the desire to put the ascertained facts to practical use.

This desire, however, is one of the strong incentives to original work, for among the satisfactions of human life, that of the discoverer takes a high place;

it ranks, perhaps, only second to those of motherhood. The scientific investigator carries his germ thought through many periods of doubt and expectation. He has to experience the disappointments of miscarriage of arguments, and experiments ; frequently his ideas end in abortive failure, but when his deductions and designs carry him on to the realization of his hopes he forgets the mental pangs and anguish in the satisfying of his soul.

The maternal magnification of infantile characteristics, is one of the pleasantries of our social life, but there is more in it than its superficial aspects suggest. To a certain extent it may be ascribed to the exultation of possession; a gladness which is well worth striving for. When the mother clasps her infant to her breast, she feels the indissoluble ties of blood relationship, but she com-

prehends also—be it ever so dimly—that she has borne into the world a new creature, a new combination of natural forces. She may perceive that in comparison with the influences of a long race of ancestors those of her husband and herself individually are almost minimal, yet instinctively she looks through and beyond the periods of physical and mental development and visions her present in the hopes of future possibilities. For her, time alone serves to diminish such a rightful enthusiasm, and even then the condition is simply the onset of a stage of philosophical expectancy. The traits of unknown forbears may come and go; the looked-for signs of family failings may leave their impress upon the life of the child; ill-balanced emotions or powers may temper the projects for livelihood. Nevertheless, she finds her chief interest

in trying to guide this "new creature" along the paths trodden by humanity.

We may follow the investigator as he passes through similar and yet dissimilar stages. The foundations of his work were laid in bygone ages, and the new fact he ascertains owes its inception to his knowledge of what has gone before, as well as to his capacity for logical argument and accurate observations. Whether the discovery is in accord with his forecast, or, as more frequently happens, is a record of something unexpected, the satisfaction of finding that something which is new, carries with it an acme of pleasure and the danger of magnification. He is advised ever to guard against an overrating of the practical value of his new possession, and to replace the natural hopes by unswerving criticism. What he has won from Nature's secret store he may not ap-

praise too highly. He must take time by the forelock, and not wait for its passing in order to attain a dispassionate calm. He may conceive the possibilities of the principle he has elucidated, but he must not permit himself to fashion its application entirely, for the joy of birth is followed by the rift of separation. The new fact, idea, or thing becomes a communal possession. Its development —if it survives the searching inquiries into its existence—lies in the hands of many. Herein, however, is the path of safety, and in such a way the interpretations of natural laws make their approaches to truth.

Science, therefore, deals with plain, unalterable facts, and the best explanations we can give of them.

In the development of the adult man, on the other hand, there has arisen a number of emotions difficult to harness

with the laws of intellectual life. His so-called passions follow irregular rather than regular lines, and his desires largely influence his habits. He loves his life because of his animal, mental, and moral kinship with his fellows. Separation from his kind tends to make him inhuman, and this obtains no matter whether the disunion be mental, moral or social. He is naturally a fighter, a hunter, a unit, and yet a communist, swayed by the feelings of the majority of his class.

When, therefore, an endeavour is made to apply the facts of science—and, in this instance, the facts of scientific nutrition—to the needs of man's daily life, we are met at the outset with several difficulties. One which perhaps at the moment bristles the most formidably owes its origin to the rush and scurry of modern life, a feature particularly

exemplified in the American peoples. It is almost a scorn to "labour and to wait," although it is widely known that Nature always fulfils her laws leisurely and completely. "The mills of God grind slowly, but they grind exceeding small." But now things must be hustled. A new method has been discovered; "no time must be lost in applying it" is the cry of to-day, and the enthusiast shouts aloud for widespread acceptance of his particular and individual views of the law, heedless of the experiences of ages, and paying no regard to the levelling aspects of time.

A second difficulty arises from the diversity of human character, habits and emotions. Although the routine processes of digestion and the building-up and breaking-down of the tissues of the body accord with certain rules and data, they are to some extent controlled by

the mind and will. This influence may, in fact, extend over long periods of time, and hastening or retarding of certain bodily functions may be directly traced to a nervous origin. An extreme example is available in cases of individuals who, from mental aberration, refuse to take their customary amount of food, and who show but little sign of emaciation. On the other hand, persons in a depressed state of mind associated with some shock, or continual worry may take large quantities of nutriment without gaining weight or even maintaining their weight; while between these extremes lie those conditions of trance or hypnosis, in which the altered activities of the brain dominate and partially suspend the general body functions.

On somewhat the same plane are the habits of families, and, indeed, those of tribes and races also. In one's own

family, there obtain numerous customs, handed down for generations, which are associated with the preparation of food and of the amount consumed. Were we to examine more closely the origin of our daily bill of fare we should probably find that these family dishes and genealogical menus play a large part. Suppose we apply this thought to our next-door neighbour, or to some of our friends; we shall be astonished at the diverse modes of living and the variations in the quantities taken. When we consider how the advances in train and boat locomotion have led to the mixing of the peoples of the hills and plains, and the introduction by marriage of foreign elements, we must appreciate the multiplicity of factors which are connected with the formation of our national habits of eating and drinking and the breadth of the subject of human nutrition.

The action of the emotions upon our daily life is also worthy of a passing mention. Look at the question in whatever way you will, it must be acknowledged that neurosis and neurotic conditions are on the increase. As a race, we have lost our stolidity, or phlegm as it was called at one time, and are travelling at a rapid pace to the stage of scaredom and neurasthenia. We fill our asylums to overflowing, and of those individuals who remain outside, quite a large proportion spend their time in devising means for excitement and super-excitement. The faddists—or fanatics—of every type gain a hearing to-day which they would never have obtained in the days of our forbears. The anti-groups of people—whether anti-vaccinators, anti-vivisectionists, anti-religionists, anti-tobacconists, anti-meat eaters, and the like—are sufficiently large enough to show

the effect of "nerves" in limiting the aspirations of our citizens. In fact, there is a real danger of a national degeneration into individuals with one idea, and a subsequent domination of our land and our existence by a crowd of shouting idealists swayed and directed by any neurasthenic who happens for the moment to stalk around on mental stilts.

It is possible to cite many other points bearing upon the complex subject of the development of man's nutritive apparatus and faculties, but we have perhaps indicated sufficiently the difficulties of the scientist who takes up this particular line of investigation. He knows that however carefully he may plan his experiments, however fully he may provide against contingencies and fallacies, the remarkable individuality of human character may seriously interfere with the application of his results to the nation in general.

The student of history is familiar with the customs of eating and drinking associated with the periodic rise and fall of empires. He follows with interest the progress in the manner of taking food and the effect on the culture of the people. He learns that civilization in its broadest aspect lessens the exhibition of animal instincts with regard to food. He observes the effect of various types of diets upon the conquering of tribes and nations, and may associate the developments in literature, music, painting, engineering and architecture with an era of rational feeding, or trace out the results of overeating and debauch in the decadence of these attainments. The lessons of modern history may impress upon him the advantages of care in nutrition and the value of adequate food in maintaining racial characteristics. But whether he considers the daily life of the ancient

Babylonian, Greek, Roman, Soho alien, or Galway peasant, he will soon realize that regularity of eating plays almost as important a part as the quantity of food taken.

There is considerable evidence to show that tertiary, and even neolithic, man satisfied his hunger when he could. Without our advanced means for preservation of materials, and possessing but few weapons of the chase, he was compelled to live very irregularly. To-day a slaughtered animal, or a find of fruit, caused him to eat to an enormous extent; to-morrow, and perhaps many to-morrows, there was nothing for him to eat. His problem is ours also. Could we postulate a definite daily ration for each member of the State, scientific nutrition would advance by leaps and bounds. A sufficient and regular amount of food for all would increase intellect,

good-fellowship, morality and population; would decrease crime and misery; would augment the resistance to infection, and would diminish disease and horrors. As yet, however, this is the dream of the idealist. At the moment we have to face the grim fact that the larger proportion of mankind has to eat when food is obtainable. The remainder is able to do otherwise and may find it difficult to restrain the animal tendency to overeat when food is set before them, but their stature, physique, mental development and reserve force forms a striking testimony to the advantages of regular, as contrasted with irregular, eating. In enunciating any system of food economics we must therefore keep in mind the periods of supply and lack.

Another aspect of the question is that of the adaptability of animal and human

tissues with regard to food. Both animals and man rapidly adapt their requirements to their circumstances. A permanently deficient supply of food leads to a reduction of body-weight and a consequently decreased demand for nutritive substances. When one type of food is substituted for another the organism fits itself to the new conditions within a very short period, and becomes readily accustomed to an excessive, normal or minimal dietary. Hence the healthy human body cannot be looked upon as an engine, or machine, whose capacity for fuel is an absolutely fixed one. The processes of nutrition, digestion and assimilation are most remarkably adaptable; a healthy person suits his condition of nutrition with astonishing ease. When an excessive amount of food is taken the absorption by the bowels is not materially increased, and

much of it passes out in the excretions; while of the additional quantity absorbed a large quantity is voided in the urine during the next twenty-four hours. If the dietary is diminished, and the general nutrition is lowered, the body tissues decrease their activities, and so reduce the demands. It is quite otherwise in diseased tissues, and this aspect of the subject demands further consideration.

During the last sixty years the science of nutrition has been continuously investigated by scientific observers. Keeping closely to recent times, it was perhaps Ludovico Cornaro and Hufeland in 1798 who chiefly emphasized the value of moderation in diet, and stimulated the statistical records and observations culminating in the valuable works of Voit, which influenced, and still will influence,

the practical feeding of masses of children or men. The further work of Rubner, Neumann, Munk, Atwater, and others, has increased our knowledge of the separate values of the starches, sugars, fats, proteids, has led to the construction of a scientific dietary, and has showed how dietaries may be varied without materially affecting the building-up and the breaking-down of tissues and the production of bodily heat. Since then there have been many recrudescences of the older views, while within the last decade it has been considered worth while to conduct on a large scale an experimental inquiry into the actual amount of proteid requisite for the satisfactory carrying out of our vital functions. It is hardly necessary to say that these experiments have nothing to do with "vegetarian" principles *qua* vegetarianism, and are solely concerned with

the quantity, and not the type, of the proteid material.

It is everywhere accorded that these experiments could not have been carried out by more competent hands than those of Chittenden. His scientific reputation, methods and experimental results are beyond reproach. Only when he makes deductions from the figures he obtained, does he open the door to criticism. It is a matter for regret that an attempt has been made to herald these inferences with a fanfare of special articles and books as an absolutely new and epoch-making discovery—one which will remedy the majority of human ills and pains, and solve many of the social problems of to-day. Although it is extremely difficult to dissociate his name from the effusions of his followers, Chittenden would be first to deny these absurd claims.

For more than a decade investigations

had been conducted towards the same end. The value of Chittenden's work lies in the replacement of isolated laboratory experiments of short duration by studies upon twenty-six persons during periods of five to twelve months. In the general plan, therefore, of the scientific investigation of nutrition the results obtained in connection with the amount of proteid food constitute a distinct advance, but do not, as some would have us believe, form the final discovery in relation to the needs of the body for the building-up and the breaking-down of its tissues.

For the practical purposes of everyday life, however, similar observations had been previously made on a much larger scale in connection with the dietary of prisoners. The following table may form the basis for a short discussion of these:

	Total amount of proteid food taken in grams.	Total amount of heat value of food taken.
1. English prison diet No. 1	57	1464
2. English prison diet No. 2	70	1684
3. Prussian prison diet	43	2000
4. French prison diet	94	2074
5. Chittenden (average)	60	1360–2000
6. English soldier (average)	130	3300
7. English sailor	121	3200
8. University student	143	3900

There are many who will remember the painful discussion upon the Prison Bill introduced in 1898 when members of the House who, at one time or another, had been inmates of our British prisons, told of the torture and privations of the No. 1 and No. 2 diets, and how an impartial and skilled inquiry revealed that, in addition to the mental and bodily discomfort, serious gastro - intestinal troubles were caused by such semi-starvation. The Prussian and French authorities arrived at similar conclusions, and, as a result, the diets No. 1–4 have

been reinforced. Yet these were all on a par with the amounts found by Chittenden as amply sufficient to maintain bodily vigour.

True, it may be argued, that Chittenden's experiments were not made upon persons possessing the low vitality of the average prisoner. The subjects were University professors, army soldiers, and the like—men who prior to the investigation had kept themselves in a good state of nutrition. Quite so: there is a distinct difference in the two classes of men. The prisoner was ill prepared for his confinement, monotony of life and his period of non-stimulating and, to him, insufficient dietary. The professors, athletes, and soldiers were in a fair condition of health to start with, but to the same conditions of regular meals, freedom from excess of alcohol and sufficiency of exercise, there was added a satisfaction

of mind and a voluntary change of diet. Perhaps this had much to do with the immediate results obtained. On the one hand there was the breaking of the spirit of the men; on the other the hope of accomplishing an end in view and the sense of content in doing something for the good of humanity.

Perhaps this comparison of the two sets of men is not a fair one. We imprison the law-breaker from the punitive standpoint. Whether such a conception is right or wrong—and it has to be remembered that many of our social usages savour strongly yet of barbarism—our civilization is so far advanced that we have decided not to make bodily starvation a part of the punishment. But we cramp the mind and depress the hopes of those we isolate from society, and apparently because of this their bodies require more food than the mentally contented

athlete, soldier or professor. The differences between the two sets of men must be contrasted, not compared. We may leave the matter at that, for the application of the results of the experiments is difficult with this simple example, and we shall gain but little advantage in following its effect upon the lower masses of the people who live well when they can and starve when they must, nor upon the middle classes whose indifference to the structure and functions of their bodies is equalled only by an uncritical acceptance of any half truth, be it duly set forth with impressive dogmatism.

Fortunately, the shouting of the few does not affect materially the position of the many. Underneath the apparent veil of indifference there rests the knowledge that the science of nutrition is only passing through another stage of its development. The majority is aware that

the last century has witnessed a gradual change in the eating habits of the race and that a tide of moderation has commenced to flow. Whither the tide will carry them, they do not trouble to think, being content to leave it in the hands of special advisers and experimental workers. Some go so far as to realize that it is the limited periods of Chittenden's experiments which form the chief bar to the propagation of the inferences made from them by their distinguished devisor and his less competent proselytes. All, however, join in tribute of thanks to this worthy band of American scientists who have carried out such difficult and laborious investigations during so many months and who have made such striking contributions to our knowledge of the subject. But we must not allow ourselves to conclude that the increases of weight, strength and general well-being of the

subjects of experiment for six to twelve months complete the tale to be told. Before the facts may be applied to the race in general, we must wait for time to unfold the entire after-life history of these individuals. We want to know the effect of upbringing, hereditary tendencies and occupation in connection with these proposed low-proteid dietaries. There must be no blinking at facts. In work like this we are working for coming generations, and just as we are reaping some of the labours of our scientific fathers, so we must be content to accumulate observations and leave much of the arrangement and judgment to those who come after us.

On general grounds, therefore, while we express the indebtedness of the world to one of the American schools of science, and consider their contentions slowly and carefully, we are compelled to deprecate

any premature practical application of the facts yielded by the particular set of observations now in question. Further experience and experiments are necessary in order to confirm in other ways the evidence at present available, and the results of these must be correlated by those in a position to judge impartially.

When, however, we take the stand that our present knowledge of physiological chemistry and human nutrition is too incomplete for dogmatic teaching, we must be careful not to repress, or deflect any further search for truth. Accordingly, we may examine advantageously some of the deductions made by the advocates of a low-proteid diet.

For this purpose it may be well to attempt to put into common speech what is meant by the terms health and disease, since certain misconceptions as to the interpretation of these words

have led to wearisome arguments and platitudes.

During the course of time necessary for man's development, the intermediate stages and progress of evolution have been associated with "reactions between living organisms and the forces, or motions, which are the properties of external media." The present stage of man's history is equally one of reaction—and the daily life of the different tissues (which make up the individual) consists of a series of responses, or reactions, to stimuli. These stimuli may arise from the demands of growth, of work, of the inner tissues of the body, or from outside impressions acting directly upon the human frame, or indirectly through the mental faculties. Health in man, therefore, is an "average state which is characterized by duration of life, power of reproduction, capacity for work and

freedom from pain." This standard of health is very broad and somewhat elastic. Deviations from this average state are due to the reactions, or responses, of the body to unusual or abnormal stimuli, and the extent of these deviations determine the amount of disease.

It is only necessary to reflect for a moment, in order to realize the complex nature of any conception of a "healthy individual." If we think of our relations and ancestors, we shall understand easily how large are the number of forces which combine to determine the stimuli and reactions, for man is not only "a bundle of nerves," but a bundle of hereditary tendencies. That these hereditary characters play a great part in our daily life all are now prepared to admit, and such an admission forms an important concession at a time when the gospel of

decreased feeding is advocated without adequate appreciation of the essential characters in which one man differs from another.

To clear the ground we may at once admit, that a proportion of the middle and upper classes consume daily more than the necessary amount of food, and that it is exceedingly probable that in course of time they will learn to diminish their intake, by a process of gradual adaptability to circumstances. But it has to be remembered that eating conduces to satisfaction, and increases the pleasure of living, and that the present age craves for the comforts of life. "Ich kann mir nicht bequemen, Das Enge Leben steht mir gar nicht an."

When a hungry man approaches a well-filled table, the problems of life's prolongation are nearly always relegated to future periods of consideration. The

stimulus to eat and digest, suffices to keep the average individual in good health; it is only the minority whose hereditary incompetency of dealing with large quantities of food is responsible for an insufficient response to the stimulus, and a consequent overloading of the tissues with badly digested material. The carnivora are not less healthy than the herbivora, and the proportion of octogenarians is not less among the human mixed feeders than among the vegetarians. Whether a universal low-proteid diet will conduce to a larger number of young old people is a question which time alone can answer.

A similar admission with regard to the lower strata of society is quite impossible. They eat when they can. Their meals are irregular both as regards time and quantity. It is conceivable that the body can subsist on smaller

amounts of food when the times of eating are regular, but with the poor this cannot be. When we discount the effects of alcohol and sexual diseases upon the physique of our poor, there remains the fact that about thirty per cent of the population exist permanently upon small quantities of food, and that much of their mental, moral, and physical energy arises from underfeeding.

Admirable as the planning of Chittenden's experiments was, it did not provide for measurements of mental conditions or for the accumulation of reserve power. One of the most important—and certainly the most carefully fulfilled—laws of Nature is the maintenance of latent forces.

To take an example from the tissues of the body, it is of interest to remember that the human liver generally works at about one quarter of its capacity, and

that the heart maintains its contractions under similar conditions. Just as the muscles contrive to obtain a greater energy for less expenditure than any known machine, so the human economy invariably carries on its work with the least possible consumption of nutritive substances, and, while assiduously rejecting unnecessary or harmful materials, accumulates elements which lead to a provision against sudden or continuous calls for work or defence. What evidence is there, that the subjects of Chittenden's experiments retained their reserve power? They put on weight and increased their athletic capabilities. But they were working under ideal conditions, conditions which, by themselves, might have led to the same end. What is their condition now? What will it be in twenty years? These are some of the questions which must be answered

before we dare to trifle with this reserve of power in the healthy individual.

We may call this reserve by another name, and express it in terms of resistance to cold, starvation, infectious diseases, or mental anxiety. And if we do this we are bound to put another query. How will this low-proteid diet affect the tendency of the race to disease, and prevent the spread of infections among communities? Are we sufficiently satisfied with the evidence adduced to change our habits of eating and venture into unknown possibilities? Had we better not move slowly, and await more information before putting into practice the views of the enthusiast? It is doubtful if these experiments of Chittenden justify any medical practitioner in departing from well-approved dietetic methods of treatment in disease. The risk of prescribing a low-proteid diet

to anyone, during recovery from an acute disease, or during the early stages or advances of tuberculosis, or during periods of mental depression, would be too great for the sake of reputation, as well as for the welfare of the patient. There is abundant evidence to show that recovery is hastened and resistance is raised to the attacks of infection on an average diet of 150 grams of proteid and an intake of 3900 calories.

It has been advanced also as worthy of practical consideration that the decomposition of proteid, yields substances which lower the well-being of the body. These substances are formed within the bowels and in the tissues, and so pass into the blood and circulate through the internal organs, being finally passed out by the kidneys. During this period they are said to exert a harmful influence upon the system, and when there is

habitual overeating of proteid food, the excess amounts of these decomposition products, cause indigestion, liver troubles, bilious attacks, gout, rheumatism and other diseases. We may say at once that there is no evidence available to support this contention as regards healthy men, and it has to be remembered that in the other conditions hereditary tendencies play a part—a part which is now regarded as the cause for the prescribing of a decreased diet. These patients must have a diet sufficient, but not more than sufficient, to keep their tissues so nutrified that they are able to work at their full strength. Minimal, or chronic underfeeding is never aimed at. But it must not be said that overeating is a cause of gout, liver troubles, and the like, for we cannot sustain the statement with evidence. Perhaps gout and similar troubles form a cause for the overeating, rather than its result.

The wearisome and somewhat sordid story of the life of an individual which has given rise to the cult of Fletcherism hardly merits comment, as it is simply the repetition of what every mother or nurse teaches the young child during its nursery life. It may be good for people who have been trained badly in the eating of food, to assimilate the ideas belonging to this set of enthusiasts, but one hopes that the majority of the race has practised sufficient mastication all through their life. The process plays a subsidiary part in the physiology of digestion, but if it is a means also of inculcating restraint in eating and increasing the desire for the "study of man," let it be practised everywhere. At all events, it may promote a condition of auditory repose which many crave for and few attain.

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